

HOUSATONIC RIVER FLOOD CONTROL

NORTHFIELD BROOK DAM & RESERVOIR

NORTHFIELD BROOK

(LOWER NAUGATUCK RIVER, BELOW THOMASTON)

CONNECTICUT

DESIGN MEMORANDUM NO.3

GENERAL DESIGN



U.S. Army Engineer Division, New England
Corps of Engineers Waltham, Mass.

JUNE 1962

28

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U. S. ARMY ENGINEER DIVISION, NEW ENGLAND
CORPS OF ENGINEERS
424 TRAPELO ROAD
WALTHAM 54, MASS.

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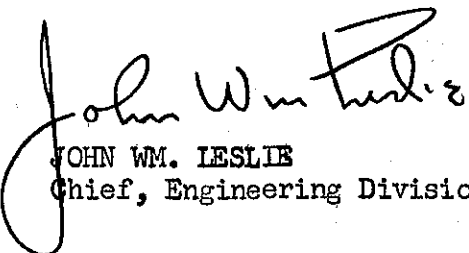
SUBJECT: Northfield Brook Dam and Reservoir - Northfield Brook -
Housatonic River Basin, Connecticut - Design Memorandum
No. 3 - General Design

TO: Chief of Engineers
ATTN: ENGOW-E
Department of the Army
Washington, D. C.

There is submitted for review and approval Design Memorandum
No. 3 - General Design for the Northfield Dam and Reservoir -
Northfield Brook - Housatonic River Basin, Connecticut, in
accordance with EM 1110-2-1150.

FOR THE DIVISION ENGINEER:

1. Incl (10 cys)
Design Memo No. 3


JOHN WM. LESLIE
Chief, Engineering Division

FLOOD CONTROL PROJECT

NORTHFIELD BROOK DAM AND RESERVOIR

NORTHFIELD BROOK

HOUSATONIC RIVER BASIN
CONNECTICUT

DESIGN MEMORANDA INDEX

<u>Number</u>	<u>Title</u>	<u>Submission Date</u>	<u>Approved</u>
1	Hydrology & Hydraulics Analysis	31 May 1962	
2	Site Geology	12 Apr 1962	8 May 1962
3	General Design	29 Jun 1962	
4	Relocations	30 Apr 1962	
5	Concrete Materials	21 Nov 1961	7 Dec 1961
6	Real Estate		
7	Embankments and Foundation		
8	Detailed Design of Structures		
9	Reservoir Management		

NORTHFIELD BROOK DAM AND RESERVOIR

NORTHFIELD BROOK

HOUSATONIC RIVER BASIN

CONNECTICUT

DESIGN MEMORANDUM NO. 3

GENERAL DESIGN

CONTENTS

<u>Paragraph</u>	<u>Subject</u>	<u>Page No.</u>
	A. PERTINENT DATA	1
	B. INTRODUCTION	
1	Purpose	6
2	Scope	6
	C. AUTHORIZATION	
3	Authorization	6
	D. INVESTIGATIONS	
5	Previous Investigations	7
6	Report of Other Agencies	8
7	Current Investigations	8
8	Coordination with Other Federal Agencies	9
9	Public Hearings	9
	E. LOCAL COOPERATION	
10	Local Cooperation	10
	F. LOCATION OF PROJECT	
11	Location of Project	10
12	Description of the Naugatuck River Basin	10

<u>Paragraph</u>	<u>Subject</u>	<u>Page No.</u>
G. RECOMMENDED PROJECT PLAN		
13	Recommended Project Plan	11
H. DEPARTURE FROM PROJECT DOCUMENT PLAN		
14	Project Document Plan	11
15	Departure from Project Document Plan	11
I. HYDROLOGY		
16	Spillway Design Flood	12
17	Flood Control Outlet	12
18	Freeboard	13
19	Reservoir Capacity	13
20	Spillway Length	13
J. GEOLOGY		
21	General	13
22	Site Geology	13
K. DESCRIPTION OF PROPOSED STRUCTURES AND IMPROVEMENTS		
23	General	14
24	Dam	14
25	Outlet Works	15
26	Spillway	16
27	Reservoir Clearing	16
28	Staff and Recording Gages	16
29	Administrative Facilities and Utilities	17
30	Access Roads and Railroad Facilities	17
31	Use of Consultants	17
L. SOURCES OF CONSTRUCTION MATERIALS		
32	Materials for Embankment Construction	17
33	Rock Protection Materials	17
34	Concrete Aggregate	18

<u>Paragraph</u>	<u>Subject</u>	<u>Page No.</u>
	M. REAL ESTATE	
35	General	18
36	Area Description	18
37	Land Requirements	19
38	Relocations	19
39	Severance Damages	20
40	Water Rights	20
41	Minerals and Crop Damages	20
42	Valuation	20
43	Conclusion	21
	N. COST ESTIMATES	
44	Cost Estimates	21
	O. SCHEDULES FOR DESIGN AND CONSTRUCTION	
45	Design	22
46	Construction	22
47	Relocations	22
48	Dam and Appurtenant Structures	22
49	Funds Required	23
	P. RESERVOIR REGULATION	
50	Reservoir Regulation	23
51	Regulation of Permanent Pool	23
	Q. OPERATION AND MAINTENANCE	
52	Operation	24
53	Maintenance	24
54	Annual Charges	24
	R. FISH AND WILDLIFE RESOURCES	
55	Fish and Wildlife Resources	25
	S. RESERVOIR MANAGEMENT AND PUBLIC USE	
56	Recreation	26

<u>Paragraph</u>	<u>Subject</u>	<u>Page No.</u>
	T. BENEFITS	
57	General	27
58	Annual Benefits	27
59	Benefit-Cost Ratio	27
	U. RECOMMENDATION	
60	Recommendation	27
	V. ACKNOWLEDGEMENT	
61	Acknowledgement	28

LIST OF PLATES

<u>Title</u>	<u>Plate No.</u>
Naugatuck River Watershed-Basin Map	1
Reservoir Map	2
General Plan	3
Dam Embankment - Profiles	4
Dam Embankment - Sections	5
Outlet Works - Profile and Sections	6
Outlet Works - Inlet Structure - Concrete Details No. 1	7
Outlet Works - Inlet Structure - Concrete Details No. 2	8
Outlet Works - Conduit - Plan and Profile	9
Outlet Works - Conduit - Sections	10
Outlet Works - Outlet Structure - Concrete Details	11
Spillway - Profile and Sections	12
Spillway - Concrete Details No. 1	13
Spillway - Concrete Details No. 2	14
Area-Capacity Curves	15

LIST OF EXHIBITS

Letter, Bureau of Public Roads	Exhibit No. 1
Letter, Federal Power Commission	Exhibit No. 2
Letter, Department of Health, Education and Welfare	Exhibit No. 3
Letter, Department of the Interior Fish and Wildlife Service	Exhibit No. 4
Letter, Department of the Interior Fish and Wildlife Service	Exhibit No. 5

NORTHFIELD BROOK DAM AND RESERVOIR
NORTHFIELD BROOK
HOUSATONIC RIVER BASIN
CONNECTICUT

A. PERTINENT DATA

1. Purpose Flood Control

2. Location of Dam

State	Connecticut
County	Litchfield
Town	Thomaston
River	Northfield Brook, 1.3 miles above its confluence with the Naugatuck River
Distance from:	
Torrington, Connecticut	9 airline miles, south
Hartford, Connecticut	22 airline miles, southwest
Waterbury, Connecticut	9 airline miles, north

3. Drainage Areas Square Miles

Northfield Brook at Damsite	5.7
Naugatuck River at Mouth, Confluence with Housatonic River	312

4. Stream Flow

Record of U.S.G.S. Gaging Station on Leadmine Brook at
Thomaston, (Drainage Area = 24.0 sq. mi.) October 1930 to
December 1959.

<u>Time</u>	<u>c.f.s.</u>	<u>c.f.s./sq. mi.</u>
Average annual (29 years)	48.6	2.03
Maximum year (1956)	73.0	3.04
Minimum year (1932)	24.2	1.01
Maximum month (March 1936)	268	11.17
Minimum month (August 1949)	0.7	0.03
Maximum day (August 19, 1955)	3,660	152.50
Minimum day (June 26, 1949)	0.1	0.004

5. Maximum Floods of Record

Record of U.S.G.S. Gaging Station on Leadmine Brook at Thomaston, October 1930 to December 1959.

	<u>Peak Discharge</u>	
	<u>c.f.s.</u>	<u>c.f.s./sq. mi.</u>
August 1955	10,400	433
December 1948	5,150	214
October 1955	3,100	129
September 1938	3,050	127

6. Reservoir Elevation, Areas and Capacities

Towns affected - Thomaston and Litchfield, Connecticut

<u>Reservoir</u>		<u>Storage</u>		<u>Inches on D. A.</u>
<u>Location</u>	<u>Elevation</u>	<u>Area Acres</u>	<u>Acre Feet</u>	
Permanent Pool	500.0	8	82	0.3
Spillway Crest	576.0	67	2,432	8.0
Maximum Surcharge	586.1	82	3,185	10.5
Top of Dam	591.0	89	3,590	11.8

7. Criteria for Spillway Design Flood

Total volume of rainfall, inches	24.4
Infiltration rate, inches per 3 hours	0.15
Total volume of runoff, acre feet	7050
Total volume of runoff, inches	23.2
Peak inflow, c.f.s.	9000
Duration of flood, days	2
Reservoir stage at start of flood, ft., m.s.l.	576.0

8. Dam

Type	Rolled Fill, earth and rock slope protection
Top elevation, feet above m.s.l.	591.0
Top width, feet	20.0
Maximum height, feet	118.0
Maximum base width, feet	700.0
Total length, feet	810.0
Slopes	Upstream
	1 on 3 below El. 505.0
	1 on 3.5 between El. 505.0 and El. 550.0
	1 on 3 above El. 550.0
	Downstream 1 on 2.5
Freeboard above spillway design flood height, feet	4.9

9. Outlet Works

Type	Precast Reinforced Concrete conduit on concrete saddle
Size of conduit (diameter), feet	3.0
Length of Conduit, feet	514.0
Gates	None*
Elevation intake sill, feet above m.s.l.	476.0

*No flood control gates - one 2' x 3' gate in control weir to dewater the permanent pool and one preset 3' x 3' gate to control the desired discharge.

10. Capacity of Outlet

Reservoir spillway crest, c.f.s.	160
Reservoir at maximum surcharge, c.f.s.	168

11. Spillway

Type	Uncontrolled, concrete ogee weir and channel on rock
Crest length, feet	72.0
Crest elevation, feet above m.s.l.	576.0
Maximum head, feet	10.1
Spillway design discharge, c.f.s.	8800

12. Real Estate (Based on acquisition in fee)

Total to be acquired, acres	250
Classification, Acres	
Improved	8
Developable	15
Gravel	25
Agricultural	50
Woodland	130
Roads and Water	22
Improvements	
Farms, Buildings and Residence	1 set
Rod & Gun Club	1
Miscellaneous	1

13. Relocations Existing Mileage Proposed Mileage

a. <u>Roads</u>		
Highways	1.2	1.8
*b. <u>Utilities</u>		
Electric Transmission Line	0.2	0.2
Electric Distribution Lines	0.8	-
Telephone Exchange Lines	0.8	-

*Utilities relocations accomplished by local interests.

14. Principal Quantities

Common Excavation (including stripping)	70,000 c.y.
Borrow Excavation	630,000 c.y.
Rock Excavation	53,500 c.y.
Embankment	
Rolled Embankment	500,000 c.y.
Gravel Bedding and Gravel Fill	42,400 c.y.
Rock Fill and Rock Slope Protection	54,000 c.y.
Concrete	1,760 c.y.
Cement	3,100 Bbl.
Reinforcing Steel	20,000 Lbs.

15. Estimated Project Costs (June 1962 Price Level)

Federal Costs

Lands and Damages	\$ 223,000
Relocations	727,200
Reservoir	4,000
Dam and Appurtenant Structures	1,300,000
Recreational Facilities	<u>50,000</u>

Sub-Total	\$2,304,200
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Preauthorization Studies	10,000
Engineering and Design	230,000
Supervision and Administration	<u>135,800</u>

Total Estimated Federal Cost	\$2,680,000
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U.S. ARMY ENGINEER DIVISION, NEW ENGLAND
CORPS OF ENGINEERS
424 TRAPELO ROAD
WALTHAM 54, MASS.

FLOOD CONTROL PROJECT

NORTHFIELD BROOK DAM AND RESERVOIR

NORTHFIELD BROOK

HOUSATONIC RIVER BASIN
CONNECTICUT

DESIGN MEMORANDUM NO. 3
GENERAL DESIGN

JUNE 1962

B. INTRODUCTION

1. Purpose. - The purpose of this memorandum is to set forth the general plan for the Northfield Brook Reservoir project and to facilitate the review of detailed design memoranda, plans and specifications.

2. Scope. - This memorandum covers the entire project. The data contained herein will be revised and expanded, as required, by supplement to this memorandum and by subsequent design memoranda.

C. AUTHORIZATION

3. Authorization. - The Northfield Brook Project was authorized by the Flood Control Act approved 14 July 1960, (Public Law 86-645) which reads in part as follows:

"The project for the flood control dams and reservoirs on the Naugatuck River, Connecticut, is hereby authorized substantially in accordance with the recommendations of the Chief of Engineers in House Document Numbered 372, Eighty-Sixth Congress, at an estimated cost of \$10,230,000."

Full monetary authorization for the project was provided in this Act.

4. In House Document No. 372, 86th Congress, 2nd Session, The Chief of Engineers recommended "the improvement of Naugatuck River by the construction of four reservoirs for flood control on Northfield Brook, Branch Brook, Hancock Brook and Hop Brook, at an estimated cost, all Federal, of \$10,230,000 for construction and \$30,000 annually for maintenance and operation. The work would be subject only to the requirement that local interests give assurances that they will establish encroachment lines downstream of the recommended dams to permit reasonable, efficient reservoir operation."

D. INVESTIGATIONS

5. Previous Investigations. a. - A preliminary report was submitted 25 June 1931 under provisions of House Document No. 308, 69th Congress, 1st Session, and covered the features of navigation, flood control, power development and irrigation. It was entitled "Housatonic River, Connecticut, Massachusetts and New York", and was printed in House Document No. 246, 72nd Congress, 1st Session

b. A review of House Document No. 246 on the Housatonic River was submitted by the District Engineer on 1 October 1936.

c. A report based on the favorable recommendation of the review report by the Board of Engineers for Rivers and Harbors, entitled "Report on Survey on the Housatonic River and Tributaries for Flood Control" was printed in House Document No. 338, 77th Congress, 1st Session.

d. An Interim Report on the Upper Naugatuck River above Torrington, Connecticut was submitted by the Division Engineer on 31 May 1956, pursuant to authority contained in resolution of Senate and House Public Works Committees, adopted September 14, 1955 and June 13, 1956, respectively. This report was printed in House Document No. 81, 85th Congress, 1st Session.

e. An Interim Report on Review of Survey for Flood Control, Housatonic River Basin, Naugatuck River was submitted by the Division Engineer on 30 June 1958, pursuant to authority contained in resolution of Senate and House Public Works Committees, adopted September 14, 1955 and June 13, 1956, respectively. This report was presented in House Document No. 372, 86th Congress, 2nd Session.

f. In the following report, the flood problem in the Naugatuck River watershed was treated as a part of the overall problem in the Housatonic Basin; The Resources of New England-New York Region, prepared by the New England-New York Inter-Agency Committee, published as Senate Document No. 114, 85th Congress, 1st Session.

6. Report of Other Agencies. - The Naugatuck Valley River Control Commission has issued an Interim Report on the Problem of Flood Control on the Naugatuck River and Tributaries and Adjacent Streams (March 1956). Various other reports have also been prepared by planning boards and other Town and State Agencies.

7. Current Investigations. - In order to determine the most practicable design for the project, basic data obtained in connection with previous studies and past reports were fully utilized. In addition the following new data was obtained and studies made:

a. New photogrammetric maps of the reservoir area were made and new area-capacity curves computed. New topographic surveys of the dam site were made.

b. All available subsurface information has been reviewed and the geological and soils investigations of foundation conditions and embankment materials are being completed.

c. Hydrologic studies have been reviewed and new studies have been made to determine the reservoir capacity, the spillway design flood and outlet requirement.

d. New appraisals of land and damages to improvements in the reservoir and work areas have been undertaken.

e. Relocation of the roads within the reservoir area have been discussed with State Officials. Preliminary studies of the affected roads are complete. Design Memorandum on Relocations was prepared and submitted on 30 April 1962.

f. Relocation of utilities have been discussed with local interests which will accomplish the relocations.

g. The Design Memorandum on Hydrology and Hydraulics was prepared and submitted on 31 May 1962.

8. Coordination with other Federal Agencies. - The Bureau of Public Roads, U.S. Department of Commerce, has advised that none of the Federal aid primary or secondary routes contemplate the use of the dam as a highway bridge. The Federal Power Commission has investigated the possibility of future development of hydro power at this site and has concluded that the power potential of this project would be relatively small and economically infeasible of development. The U.S. Public Health Service has prepared a preliminary evaluation report on vector problems for this project. Comments from these agencies are reproduced following Table III page 31. The U.S. Fish and Wildlife Service has investigated the effect of the project upon fish and wildlife resources of the area and has submitted a report. See paragraph 55 of this memorandum.

9. Public Hearings. a. - A public hearing was held at Great Barrington, Massachusetts, on 21 July 1936 in connection with the review report submitted on 1 October 1936.

b. A public hearing was held at Waterbury, Connecticut, on 25 July 1939 in connection with the survey report submitted on 20 June 1940.

c. A public hearing was held at Waterbury, Connecticut on 9 March 1949, by the Flood Control and Water Policy Commission of the State of Connecticut for the purpose of ascertaining public opinion concerning construction of the Thomaston Dam. At this hearing, public sentiment was opposed to the construction of the dam.

d. An informal public meeting was held at Thomaston, Connecticut, on 14 March 1956 following the disastrous flood of August 1955. Local interests urged accelerated action on the construction of Thomaston Project.

e. A public hearing on the Naugatuck River for flood control and allied purposes was held at Waterbury, Connecticut, on 11 December 1956. At this hearing the public voiced the urgent need of more flood control protection in addition to the authorized Thomaston Reservoir.

f. A public hearing was held at Torrington, Connecticut on 26 January 1960 by the Connecticut State Highway Department in conjunction with the relocation of State Route 72 necessitated by the construction of Hall Meadow Brook Dam. Representatives of the

Corps of Engineers attended this meeting. There was no objection voiced to the alignment for the proposed relocation and to the project in general.

g. A public hearing was held on 16 April 1962 by the Selectmen of the Town of Litchfield in conjunction with the relocation of Knife Shop Road. Representatives of the Corps of Engineers attended this meeting. The town people overwhelmingly rejected the dead ending of Knife Shop Road and approved that a connection be provided between this road and the relocated State Road 854.

E. LOCAL COOPERATION

10. Local Cooperation. - The Act authorizing Northfield Brook Reservoir project only requires that local interests give assurances that they will establish encroachment lines downstream of the recommended dam to permit reasonably efficient reservoir operation. All construction costs of the project will be met with funds of the United States.

The State of Connecticut has enacted legislation necessary to comply with the requirements of local cooperation. Preliminary assurances of local cooperation have been furnished and formal assurances are expected in the near future.

F. LOCATION OF PROJECT

11. Location of Project. - The Northfield Brook Reservoir Project is located within the Towns of Thomaston and Litchfield. The reservoir is formed by a dam located on Northfield Brook about 1.3 miles above its confluence with the Naugatuck River and a spillway in the east abutment. The reservoir extends up the Northfield Brook about 1.5 miles. The total drainage area of Northfield Brook is 6.6 square miles and the drainage area at the dam site is 5.7 square miles. See Basin Map-Plate No. 1 and Reservoir Map, Plate No. 2.

12. Description of the Naugatuck River Basin. - The Naugatuck River, principal tributary of the Housatonic, is a rapidly flowing, non-navigable stream. The watershed, which lies wholly within the western part of Connecticut, is about 50 miles long with a maximum width of 12 miles and a total drainage area of 312 square miles. The drainage area at Torrington is about 50 square miles. The headwaters of the Naugatuck lie about 6 miles south of the

Massachusetts line in the southeast corner of the Town of Norfolk at an elevation of about 1,500 feet. Between the headwaters and Torrington, the river falls approximately 900 feet in about 13 miles. The general direction of flow is southerly, through Torrington, Thomaston, Waterbury, Naugatuck, Beacon Falls, Seymour, and Ansonia to Derby, where the Naugatuck, joins the Housatonic in its tidal reach, about 12.25 miles from Long Island Sound.

The Naugatuck River is formed in the City of Torrington by the confluence of its West and East Branches. The River is fed by relatively small steeply falling brooks. The other principal tributaries are Leadmine Brook, Branch Brook, Steel Brook, Hancock Brook, Mad River, Hop Brook, Bladens River, Northfield Brook and Little River. See Basin Map, Plate No. 1.

G. RECOMMENDED PROJECT PLAN

13. Recommended Project Plan. - The recommended project plan for the Northfield Brook Reservoir includes the construction of: (1) a dam on Northfield Brook about 1.3 miles above its confluence with the Naugatuck River with the outlet works founded on rock in the west abutment; (2) a spillway adjacent to the east abutment of the dam; (3) approximately 1.7 miles of relocated highway; and (4) relocation of utilities. See Reservoir Map, Plate No. 2.

H. DEPARTURE FROM PROJECT DOCUMENT PLAN

14. Project Document Plan. - The Northfield Brook project was authorized under the Flood Control Act of 14 July 1960 in general accordance with the plan presented in House Document No. 372, 86th Congress 2nd Session. This plan proposed flood control storage of 2430 acre-feet, equivalent to 8 inches of runoff from the tributary drainage area of 5.7 square miles. From the available USGS quadrangle sheets, this capacity set the spillway crest elevation at 573 feet, mean sea level.

15. Departure from Project Document Plan. - The following modifications and changes from the approved document plan have been made during the development of detailed studies based on additional investigation and information obtained.

a. Area-capacity curves developed from the new photogrammetric maps of the reservoir indicated that to obtain the authorized storage of 8 inches, the spillway crest elevation would have to be at 576 feet, mean sea level. See Area-Capacity Curves, Plate No. 15.

b. Results of economic studies based on surcharges versus spillway lengths and on the alignment of the relocated road indicate that a 10.1-foot surcharge should be adopted for the spillway.

c. Results of embankment design have indicated that the upstream and downstream slopes of the dam would have to be flattened. The embankment has been modified to utilize fully all available materials from required excavations and from nearby available borrow materials.

d. The Highway Department of the State of Connecticut upon completion of economic studies recommended that State Road 854 be relocated on the west side rather than the east side of the reservoir as originally planned. This change necessitated moving the spillway to the east abutment from the west abutment. A connection from Knife Shop Road to State Road 854 will also be provided.

I. HYDROLOGY

16. Spillway Design Flood. - The spillway design flood represents the most severe condition of run-off that would result from the probable maximum precipitation over the watershed falling on ground saturated from previous rains. Concurrently it is assumed that the reservoir is filled to spillway crest and that the outlet is inoperative. The probable maximum precipitation over the watershed amounts to 24.4 inches in 24 hours with 19.2 inches occurring in a 6-hour period. Infiltration, surface detention and other losses are assumed at the rate of 0.05 inches per hour, resulting in a total rainfall excess of 23.2 inches. The adopted spillway design flood with a peak inflow of 9,000 c.f.s. was developed by applying the rainfall excess to the adopted unit hydrograph for the net drainage area above the dam. Routing the flood through the reservoir results in a maximum surcharge elevation of 586.1 feet, m.s.l. and a maximum discharge of 8,800 c.f.s.

17. Flood Control Outlet. - The estimated channel capacity of 160 c.f.s. downstream of the dam was the deciding factor in determining the size of the outlet. For the required length of 566 feet an ungated 30-inch circular conduit would discharge 160 c.f.s. with the pool at spillway crest elevation. However, as inspection and maintenance of a 30-inch conduit of this length would be quite difficult, a 36-inch diameter was considered to be a practical minimum size. A 36-inch circular conduit with a 3-foot x 3-foot sluice gate at the entrance locked in a predetermined

position with a 1.1-foot opening also met the desired discharge capacity and was adopted.

18. Freeboard. - A freeboard of 4.9 feet above the maximum surcharge pool elevation of 586.1 is provided resulting in a top of dam elevation of 591.0 feet, m.s.l.

19. Reservoir Capacity. - Prior to 1955 it was considered that there should be sufficient storage capacity in a flood control reservoir to hold 6 inches of run-off from the watershed upstream of the project. Following the major floods of 1955, a reappraisal was made of storage requirements in flood control reservoirs in New England. In general, the volume of run-off experienced in the 1955 floods has demonstrated that it is desirable to provide at least 8 inches whenever feasible. On this basis, the Northfield Brook project was recommended for authorization as an 8-inch flood control reservoir. Prior to final authorization, the storage was modified to provide for a small permanent pool to mitigate fish and wildlife losses, thereby giving 7.7 inches of flood control storage.

20. Spillway Length. - Assuming various lengths of spillway from 50 to 100 feet, the spillway design flood was routed through the surcharge storage with the reservoir full to determine the effect on surcharge head and corresponding elevation for the top of dam. Economic studies indicated that the length should be kept to a minimum. Physical limitations in connection with relocations and freeboard criteria imposed a maximum surcharge at 10.1 feet. The selected spillway length of 72 feet satisfied these requirements.

J. GEOLOGY

21. General. - The Northfield Brook Dam Site is located in the western highlands of Connecticut, a rugged upland of moderate relief which is underlain by Paleozoic crystalline rocks. The upland is maturely dissected with rough, steep-sided hills and ridges rising above relatively narrow valleys. Glaciation has modified the topography by smoothing and rounding the crests of the hills and ridges and filling the bottoms of the valleys with outwash materials and till. The folds of the crystalline bedrocks of the region, mainly schists and gneisses, trend generally north-south.

22. Site Geology. - At the site, bedrock protrudes through the thin overburden in numerous and extensive outcrops. The overburden consisting generally of outwash in the valley bottom

with outwash and highly modified till on the abutments, is variable, silty sands and gravels. Bedrock is mainly quartz mica schist which has been partly granitized locally and also includes some zones of granitic rocks. The schist is very well foliated with the foliations trending generally north-south and dipping westward. Below the nominal weathered zone which ranges in thickness from 1 to 5 feet the rock is fresh except for local weathering along occasional open foliation planes and closely jointed zones which extend in some areas to depths of more than 20 feet below the rock surface. More detailed discussion of the geology and foundation conditions is presented in Design Memorandum No. 2, "Site Geology" and Design Memorandum No. 7, "Embankments and Foundation".

K. DESCRIPTION OF PROPOSED STRUCTURES AND IMPROVEMENTS

23. General. - A description of each of the principal elements of the proposed plan of improvement for the Northfield Brook Reservoir Project is presented in the following paragraphs. Studies to develop design details for each element are under way and will be presented in subsequent Design Memoranda.

24. Dam. - The dam to be constructed across Northfield Brook is composed of a rock and rolled earth fill embankment 810 feet in length and having a maximum height of 118 feet above stream bed. The top elevation is at 591 feet above mean sea level which provides for a 10.1-foot spillway surcharge and 4.9-foot freeboard. The top width of the dam is 20 feet with a 14-foot gravel surface roadway. Highway guard rails will not be provided since access will be limited to official use only. Access to the top of the dam will be from the relocated road on the west abutment.

On the basis of the foundation conditions, the availability and characteristics of borrow materials, and the utilization of materials from the required excavation, an embankment section has been selected which consists of a large impervious fill zone of compacted glacial till, a random fill zone, a small upstream and a small downstream rock fill toe, rock slope protection, gravel bedding, a pervious internal wick drain, and a pervious drainage blanket in the downstream portion of the embankment. The rock will be obtained from required rock excavations and the impervious embankment materials will be obtained from a borrow area located adjacent to and upstream of the east abutment of the dam. Materials from required earth excavations in the dam foundation area will be utilized in the random fill zone. The embankment

slopes, on the basis of experience with other designs using similar materials, have been tentatively established upstream at 1 on 3 from top of dam to elevation 550, thence 1 on 3.5 to elevation 505 where a 12-foot berm has been provided as access to the intake structure, and 1 on 3 below elevation 505; downstream 1 on 2.5 slope. Seepage through the embankment will be controlled by the arrangement of zones of materials with different permeabilities. Seepage through the embankment foundation will be controlled by an impervious foundation cut-off to bedrock, a contiguous grout curtain in the bedrock, a pervious drainage blanket, and a downstream rock-fill toe. Both the drainage blanket and the rockfill toe will be in contact with the bedrock surface over most of the downstream portion of the embankment. The above-described embankment section is considered to be tentative pending completion of all subsurface investigations and embankment design studies. For embankment plan, profiles and sections see Plate Nos. 3, 4, and 5.

25. Outlet Works. - The outlet works are located on the west abutment under the dam and founded on rock, and consist of an inlet channel, an inlet structure, a conduit, and an outlet channel. See Plate Nos. 6, 7, 8, 9, 10, and 11.

a. The inlet channel is excavated in earth and rock and is about 110 feet long with a bottom width of 10 feet and invert elevation of 480 feet, m.s.l. On the east side a short section of gravity wall separates the channel from the dam embankment.

b. The inlet structure, founded on rock, contains a reinforced concrete control weir with crest elevation 498 feet m.s.l. and a conduit transition having an overall length of 12 feet with invert elevation at 476 feet, m.s.l. Stop-logs are provided to control and operate the permanent pool. A 2' x 3' manually operated gate is provided upstream of the structure for the flow of the stream during construction, and before a permanent pool is established, and to operate and dewater the permanent pool. A 3' x 3' manually operated sluice gate is provided at the entrance of the conduit. The gate will be locked in a predetermined position with a 1.1-foot opening to control the desired discharge capacity of the conduit. A 12-inch steel pipe air vent will be provided. A structural steel trash rack is also provided.

c. The 36-inch circular conduit is 544 feet long sloping from an upstream invert elevation of 476 to an invert elevation of 474 at the outlet portal. The conduit is precast

36-inch diameter reinforced concrete pipe on a concrete cradle founded on rock. A grout ring in line of the foundation cut-off trench and two seepage collars will be provided.

d. The outlet channel, excavated in rock and earth, is 14 feet wide and approximately 315 feet long, having a 2.5 percent slope from elevation 472 feet, m.s.l. to the brook. Downstream of the conduit portal for a length of 25 feet, a reinforced concrete structure is provided for the transition. A stilling basin is not considered necessary.

26. Spillway. - The spillway is located adjacent to the east abutment of the dam and separated from the embankment by a concrete retaining wall. The spillway is an uncontrolled, fixed-crest, trapezoidal weir with a crest length of 72 feet at elevation 576.0 feet, m.s.l. The weir will be designed as a gravity ogee section founded on rock and, if required, an upstream grout curtain will be provided under the weir to minimize uplift. The structure has a maximum discharge capacity of 8,800 c.f.s. (the outflow for the spillway design flood) under the design head of 10.1 feet. Flood discharges over the structure will occur infrequently and no improvement is planned in the valley immediately below the spillway discharge channel.

The spillway approach channel excavated in rock and earth is about 210 feet long. It has a maximum invert elevation of 571 at the weir and it slopes down from the weir at one percent grade. The spillway chute or discharge channel excavated in rock and earth is about 850 feet long. It slopes down from invert elevation 571 at the weir to invert elevation 520, in 228 feet, and thence to invert elevation 465, in 340 feet, and one percent grade to the end. Final grades and sections were determined to provide the minimum required rock for the dam embankment. Earth excavation will be utilized as a random fill.

Operations will proceed at a rate that will allow the excavated materials to be placed in the embankment with minimum stockpiling. See Plate Nos. 12, 13, and 14.

27. Reservoir Clearing. - The portion of the reservoir below the permanent pool will be cleared.

28. Staff and Recording Gages. - A series of staff gages and a recording gage of the bubbler type will be provided for reading and recording reservoir stages.

29. Administrative Facilities and Utilities. - No administrative facilities and utilities are provided. Maintenance and operation will be under the supervision of the dam tender of the nearby Thomaston Dam.

30. Access Roads and Railroad Facilities. - a. - Highways. - The site is located on State Road No. 854 which will be relocated. The reconstructed road will be adjacent to the west abutment of the dam and will serve as the main access road. Access to the dam will be limited for official use only. Access to the reservoir and permanent pool areas will be via existing State Road No. 854 which will be connected to the relocated road. A 12-foot wide service road will be provided from existing State Road No. 854 as access to the inlet structure.

b. Railroad Facilities. - The New York, New Haven and Hartford Railroad serves Thomaston which is the nearest railroad freight station.

31. Use of Consultants. - The Northfield Brook Reservoir Project imposes no complex design problems. Technical specialists in the Office, Chief of Engineers were consulted and their services utilized in establishing the design criteria and the design and safety of the proposed structures and facilities.

L. SOURCES OF CONSTRUCTION MATERIALS

32. Materials for Embankment Construction. - Materials for construction of the major portions of the earth embankment will be obtained from a borrow area located approximately 1/4 mile upstream and east of the dam site. The material in the borrow area is predominantly a sandy glacial till.

Pervious materials for the internal drainage features will be furnished by the contractor. Adequate quantities of suitable materials are available from several commercial sources located within 10 miles of the site in the Naugatuck River Valley, southwest of Thomaston, Connecticut, and in the reservoir area of the proposed Hancock Brook Dam, northeast of Waterbury, Connecticut.

33. Rock Protection Materials. - Sound durable rock, suitable for use as dumped rock fill or slope protection, will be obtained from required rock excavations.

34. Concrete Aggregate. - Aggregate studies made for other projects recently completed or under construction in this same general area, indicated that approved materials are available from commercial sources within a 25-mile haul distance of the project.

M. REAL ESTATE

35. General. - The acquisition of land for the Northfield Brook Reservoir will be in conformity with the criteria set forth in EM 405-2-150 dated 1 October 1958 as amended.

36. Area Description. - The Northfield Brook Reservoir has been named for the swift-flowing narrow stream which joins the Naugatuck River at the Town of Thomaston, Connecticut. About 1.3 miles above this confluence within the Town of Thomaston, it is proposed to construct a rock and rolled earth-filled dam with a non-regulated spillway at the foot of a narrow valley along Litchfield Road. The proposed storage basin will extend about 1.5 miles up the valley, a few hundred feet into the Town of Litchfield, and require the relocation of the highway along the westerly side of the enclosing ridge. The reservoir area is sparsely developed due primarily to the rather steeply sloped ridges, which provide little level land suitable for development along the road. From the dam site south into the Town of Thomaston proper, residential development becomes increasingly dense. Only three improved properties are within the subject area, which includes an estimated 250 acres. At the dam site, a small former farm on which the residence was destroyed by fire has since been improved with a modern contemporary single-family home. The original outbuildings remain, and the acreage assures privacy but is not used for agricultural purposes. Nearly all of the excess land will be required for the dam site, but the main buildings will not be disturbed. Near the center of the reservoir, a former dairy farm (subsequently converted to poultry) with a large number of outbuildings and an older but substantial residence will be acquired. A large, well-designed building which houses the Thomaston Rod and Gun Club is further up the reservoir on a large sloping lot that provides a natural setting which includes a small trout stream. The building is just above the guide taking line; but access will be lost due to inundation and relocation of Litchfield Road, requiring the fee purchase of the property.

Developable land in this hilly area is currently at a premium, and several sites along the road would find a ready market for residential construction in the near future. Much of the remaining land is lightly wooded, but there is little growth of

sufficient quantity or quality to require special consideration as merchantable timber.

37. Land Requirements. - The minimum guide taking line established at elevation 581' m.s.l. provides 5' above spillway crest for surcharge and saturation and encompasses an estimated 75 acres of which about 10 acres will be a permanent pool. Actual real estate requirements will extend well beyond this minimum elevation.

The proposed relocation of State Road #854 is on the west side of the enclosing ridge and will occupy a strip about 200 feet in width. An irregular narrow strip to the top of the retention basin is below the new right-of-way. Since this strip has little value, it is proposed to extend the limits of the reservoir to the edge of the road relocation at little or no additional cost, thereby providing full public access on the west side and avoiding potential encroachment. The relocated road will provide adequate access to each bisected ownership in order to reduce severance damages.

On the east side (based on preliminary and incomplete tract ownership data), the present location of the road appears to be the only access; and, following normal real estate practices, these properties will be acquired in entirety. The actual fee area will, therefore, extend to elevation 590' m.s.l.; and the total area to be acquired for the retention basin will be about 130 acres. In addition, the dam site and work area will occupy approximately 30 acres; and the borrow area, located at the southeast corner of the reservoir, will include about 100 acres. In the proposed borrow area, about 10 acres are in the reservoir below the guide taking line of 581 feet; and an additional 60 acres would be acquired due to loss of access so that only about 30 acres are proposed for acquisition for this specific purpose. Total land requirements in fee are estimated at 250 acres. It is not anticipated that any land will be acquired under flowage easement. It is currently estimated that the total land requirements will involve 30 ownerships.

Since detailed tract ownership data and defined relationships of guide taking lines to property boundaries are not currently available in adequate quantity, land acquisition cost estimates are approximations based on the analysis of improvements and field reconnaissance by staff personnel, and are subject to subsequent refinement.

38. Relocations. - No real estate costs are estimated for relocations in this section. (For general description of the relocations, refer to: DESIGN MEMO #4, "Relocations", submitted 30 April 1962.)

39. Severance Damages. - The proposed fee acquisitions will almost eliminate severance damages. Two improved properties will be severed, and some severance damage may occur in relation to partial acquisitions where remainders will be less than economically usable units. Severance damage is estimated at \$4,000.

40. Water Rights. - No commercially valuable water rights are known to exist in the reservoir area.

41. Minerals and Crop Damages. - No instance of special value attributed to mineral deposits or growing crops has been noted. One gravel bank has been opened for private use in the borrow area.

42. Valuation. -

a. Land. -

<u>Classification</u>	<u>Area</u>	<u>Unit Value</u>	<u>Total Value</u>
Improved	8 A. @	\$3,000	= \$ 24,000
Developable	15 A. @	2,000	= 30,000
Gravel	25 A. @	1,000	= 25,000
Agricultural	50 A. @	300	= 15,000
Woodland	130 A. @	50	= 6,500
Roads and Water	22 A. @	-0-	= -0-
	250 A.		\$100,500

b. Improvements. -

Estimated Total

1 Set Farm Bldg. & Residence)	}	= \$ 60,000
1 Rod & Gun Club		
1 Miscellaneous		

TOTAL LAND & IMPROVEMENTS . . \$160,500

c. Severance Damage 4,000

d. Contingencies (10% of above) 16,450

e. Resettlement Costs 2,000

f. Acquisition Costs (Est. 50 Tracts @ \$800) 40,000

TOTAL REAL ESTATE COSTS \$222,950
Rounded to \$223,000

43. Conclusion. - Derivation of values, costs and other data contained in this estimate will be more fully discussed in REAL ESTATE DESIGN MEMORANDUM NO. 6. Pending submission and approval of the Reservoir Management Plan, no provision has been included herein for possible requirements of land for additional public access or for wildlife or recreational purposes.

N. COST ESTIMATES

44. Cost Estimates. - The total estimated cost of the Northfield Brook Reservoir Project is \$ 2,680,000 . A summary of the cost of the various features of the work described in this Design Memorandum is given in TABLE I below. Breakdown estimates are given in TABLE III, page 29 .

TABLE I

SUMMARY OF FEDERAL COSTS (June 1962 Price Level)

ENR Construction-Cost Index June = 871.60 (1913=100)

<u>Project Features</u>	<u>Cost</u>
Lands and Damages	\$ 223,000
Relocations	727,200
Reservoir	4,000
Dam (Embankment, Spillway and Outlet Works)	1,300,000
Recreational Facilities	<u>50,000</u>
Subtotal	\$2,304,200
Preauthorization Studies	\$ 10,000
Engineering and Design	230,000
Supervision and Administration	<u>135,800</u>
Total Estimated Federal Project Cost	\$2,680,000

O. SCHEDULES FOR DESIGN AND CONSTRUCTION

45. Design. - Preparation of plans and specifications for the relocation of State Road 854 will be completed by the Connecticut State Highway Department in Fiscal Year 1963. Preparation of plans and specifications for the dam and appurtenant structures will be completed in September 1962.

46. Construction. - It is estimated that 2 full and 2 partial construction seasons will be required for the completion of this project.

47. Relocations. - State Road 854 passes through the dam site. Therefore, its relocation must be initiated early in the construction program to clear the work area for the construction of the dam. The budget for F. Y. 1963 submitted to Congress for approval does not contain funds to initiate construction for the Northfield Brook Project. Therefore, on the assumption that funds will not be made available before F. Y. 1964 the construction of the relocated road will be initiated in the Fall of 1963 and completed in the Fall of 1964. The work will be accomplished under an agreement with the Connecticut State Highway Department which will administer the construction contract. Construction of the relocation of electric power and telephone lines will be accomplished under separate contracts to be negotiated with the respective utility companies in Fiscal Year 1964.

48. Dam and Appurtenant Structures. - Construction of the dam, outlet works, spillway and the clearing of the reservoir will be accomplished under a single continuing contract to be awarded in the fall of 1964.

a. First Season. - During the remainder of the 1964 construction season, the contractor will mobilize and initiate and complete the clearing and grubbing of the site of the structures and the borrow area, and the clearing of the reservoir area.

b. Second Season. - During the 1965 construction season the contractor will initiate and complete (1) the stripping for the embankment and borrow area, (2) the foundation cut-off trench and grout curtain wall, (3) the outlet works so that the brook could be diverted in the early summer. To effect the brook diversion and construct the dam embankment in the dry, temporary upstream and downstream cofferdams will have to be constructed. Since the volume of the dam is not large the need of a permanent cofferdam is not deemed necessary.

The contractor will initiate the construction of the spillway. After diversion he will initiate the construction of the dam embankment and will construct it to elevation 550 by 1 November 1965.

c. Third Season. - During the 1966 season the contractor will continue and complete the construction of the spillway, dam embankment and all other work to complete the project by 1 July 1966.

49. Funds Required. - The construction schedule is based on the assumption that funds for construction of the project will be first appropriated in Fiscal Year 1964, and that additional funds will be appropriated as required. It is estimated that funds will be required by fiscal years approximately as follows:

<u>Fiscal Year</u>	<u>Construction Schedule Amount Required</u>
1964	400,000
1965	1,000,000
1966	<u>1,066,000</u>
Sub-Total	\$2,466,000
Allotted To Date	<u>214,000*</u>
TOTAL	\$2,680,000

* Includes \$10,000 for preauthorization studies.

P. RESERVOIR REGULATION

50. Reservoir Regulation. - The outlet consists of a 36-inch circular conduit with a 3-foot x 3-foot sluice gate at the entrance locked in a predetermined position with a 1.1-foot opening and discharging into Northfield Brook. Flood flows exceeding the capacity of the gate opening would be automatically stored in the reservoir. The size of the gate opening will permit passage of the normal flow of the river without appreciable storage in the reservoir.

51. Regulation of Permanent Pool. - Regulation of the permanent pool will be accomplished by means of the control weir which has a crest elevation of 498 and which is provided with stop-logs. A hand-operated slide gate located in the control weir structure will permit dewatering of the pool, if required.

Q. OPERATION AND MAINTENANCE

52. Operation. - No flood control operation will be required. The dam will automatically reduce flood discharges along the Northfield Brook in Thomaston and in the Lower Naugatuck River downstream of the constructed Thomaston Reservoir.

53. Maintenance. - The dam and reservoir will be maintained by a staff under the supervision of the damtender of the nearby Thomaston Dam. Maintenance will be based on regular, detailed inspection of the entire works, and include all actions necessary to preserve the structures.

54. Annual Charges. - Annual charges given in Table II below have been computed as outlined in EM 1120-2-104 using an economic life span of 100 years for the project. The salvage value of land and net loss of land is not included. The loss in taxes is expected to be offset by increased value and productivity of lands downstream of the project.

TABLE II

ANNUAL CHARGES

Federal Investment

Total First Cost	\$2,680,000
Interest During Construction ($\frac{1}{2}$ of 3 year period at 2.625%)	105,500
Gross Investment	<u>\$2,785,500</u>

Federal Annual Charges

Interest on Gross Investment at 2.625%	\$ 73,100
Amortization of Gross Investment, 100 years at 2.625%	5,900
Maintenance and Operation	2,000
Loss of Productivity of Lands \$100,500 x (.06-.035) x 3	<u>7,500</u>
Total Annual Charges	\$ 88,500

R. FISH AND WILDLIFE RESOURCES

55. Fish and Wildlife Resources. - The U. S. Fish and Wildlife Service has prepared a conservation and development report on the fish and wildlife aspects of 4 proposed flood control reservoirs on the Naugatuck River in Litchfield and New Haven Counties, Connecticut. The Northfield Brook Dam and Reservoir is one of the four dams included in this report. This report, dated April 25, 1960, was prepared in cooperation with the Connecticut State Board of Fisheries and Games and has the concurrence of that agency. The report is included as Exhibit No. 5. On July 27, 1961 the Fish and Wildlife Service stated that no further report or revisions in the original report were considered necessary, see Exhibit No. 4. Specific recommendations are contained on pages 8 and 9 of the report.

Following are the comments of this office to the specific recommendations (1) to (10) inclusive, contained in letter, dated 25 March 1960, to the Region 5 Director of the Fish and Wildlife Service, Department of the Interior:

1 & 2. We are recommending modification of the proposed structure to accomplish the creation of the pool with attendant control for the purpose of mitigating losses to fish and wildlife resources which would result from project construction, in accordance with your recommendations.

3. Not applicable to this project.

4. It is our policy to maintain and if warranted, to provide adequate access for public use within the reservoir area. We concur in the recommendation.

5. Every effort will be made to minimize the deposition of sediment in streams and to preserve the existing streamside vegetation.

6. We concur.

7. We are happy to cooperate in this mutually advantageous procedure and have so advised the Director of the Water Resources Commission of the State of Connecticut by letter dated 14 January 1960.

8. Not applicable to this project.

9 & 10. We will be glad to have continuing studies and comments over the life of the project which may improve or supplement measures taken for the conservation and development of the fish and wildlife resources, and will cooperate in the implementation of any measures within our authority.

As a means of mitigating losses to the recreational and fish and wildlife resources which will result from the operation of the project, provision has been made for the inclusion of a permanent pool at elevation 500 feet, m.s.l., which will have surface area of 8 acres and a maximum depth of 20 feet. Control of pool levels is effected by a stop-log structure with a gate for dewatering the reservoir.

The Board of Fisheries and Game of the State of Connecticut is prepared to undertake management activities under a suitable license agreement.

Detailed discussion of the fish and wildlife program will be contained in Design Memorandum No. 9, Master Plan for Reservoir Management.

S. RESERVOIR MANAGEMENT AND PUBLIC USE

56. Recreation. - The Northfield Brook Reservoir, with the permanent pool located in the confines of a narrow scenic valley will provide a desirable multi-use area for public recreation. The pool will add to the excellent potential of the reservoir for development as a day-use, park-type area. The portion of Northfield Brook, within the reservoir, is an important trout stream and will provide excellent opportunities for sport fisherman in this area of the State. These appear to be the highest and best uses of the recreational potentials of the project.

The reservoir is located in a populous area of West Central Connecticut. The 1960 census shows a population of 1.1 million people within a 25-mile radius of the project. This represents a growth of about 23 per cent over the 1950 census. The number of licensed sportsmen within a ten-mile radius is about 14,500. Pressure is constantly increasing for public recreation areas in this section of the State.

Determination of the extent and type of basic facilities to be provided for the accommodation of the using public will be made after further consultation with interested Federal and State agencies. The recommended program will then be incorporated in the Master Plan for approval.

T. BENEFITS

57. General. - The densely populated Naugatuck River Valley is one of the key industrial concentrations in the United States. The Valley's industries produce about 40% of the country's brass, and bronze industrial shapes and a large part of the aluminum, zinc, and copper products.

The destructive flood of August 1955, caused damages of \$194,000,000 in the reaches of the Naugatuck River below Thomaston Reservoir. Thirty-six lives were lost. A recurrence of this flood under today's economic conditions and with Thomaston Reservoir and Waterbury local protection in operation would cause losses estimated at \$53,500,000. The Northfield Brook project, acting after Thomaston Reservoir and in a system with three other authorized reservoirs, Hancock Brook, Black Rock and Hop Brook, would prevent \$3,300,000 in losses in such a recurrence.

58. Annual Benefits. - Annual benefits were derived by determining the difference between annual losses remaining after operation of Hall Meadow and East Branch Reservoirs and local protection at Waterbury, all built or under design, and those remaining after operation of the above-mentioned reservoirs acting as a system with Northfield Brook receiving an equitable share of the benefits. Annual losses, before and after the project, were adjusted to reflect the growth expected to occur in the areas of project influence over the hundred year life of the project. Average annual benefits so derived amount to \$1148,000 at present day price level.

Assuming that Northfield Brook is the last added project in a system of seven reservoirs and a local protection project the annual benefit is \$130,800.

59. Benefit-Cost Ratio. - The annual cost, as shown in Paragraph 54 is \$ 88,500 . The ratio of benefit to cost is 1.67 to 1.

U. RECOMMENDATION

60. Recommendation. - It is recommended that the plan presented herein for the development of the Northfield Brook Dam and Reservoir project be approved as to its general features as a basis for further design studies and preparation of contract plans.

V. ACKNOWLEDGEMENT

61. Acknowledgement. - The report was prepared under the general supervision of Messrs. John Wm. Leslie, Chief, Engineering Division; John C. Dingwall, Chief, Planning and Reports Branch; and Harry F. Shea, Chief, Foundation and Materials Branch; by Mr. Domenick W. Caprio, Project Engineer, with assistance from the following:

N. Lally	Hydrology and Hydraulics
H. Verville	Geology
E. H. Baker, Jr.	Soils
G. A. Haskins	Road Relocations
F. J. Ravens, Jr.	Utility Relocations
W. B. Battis	Real Estate
J. J. Madden	Reser. Devel. & Public Use

TABLE III

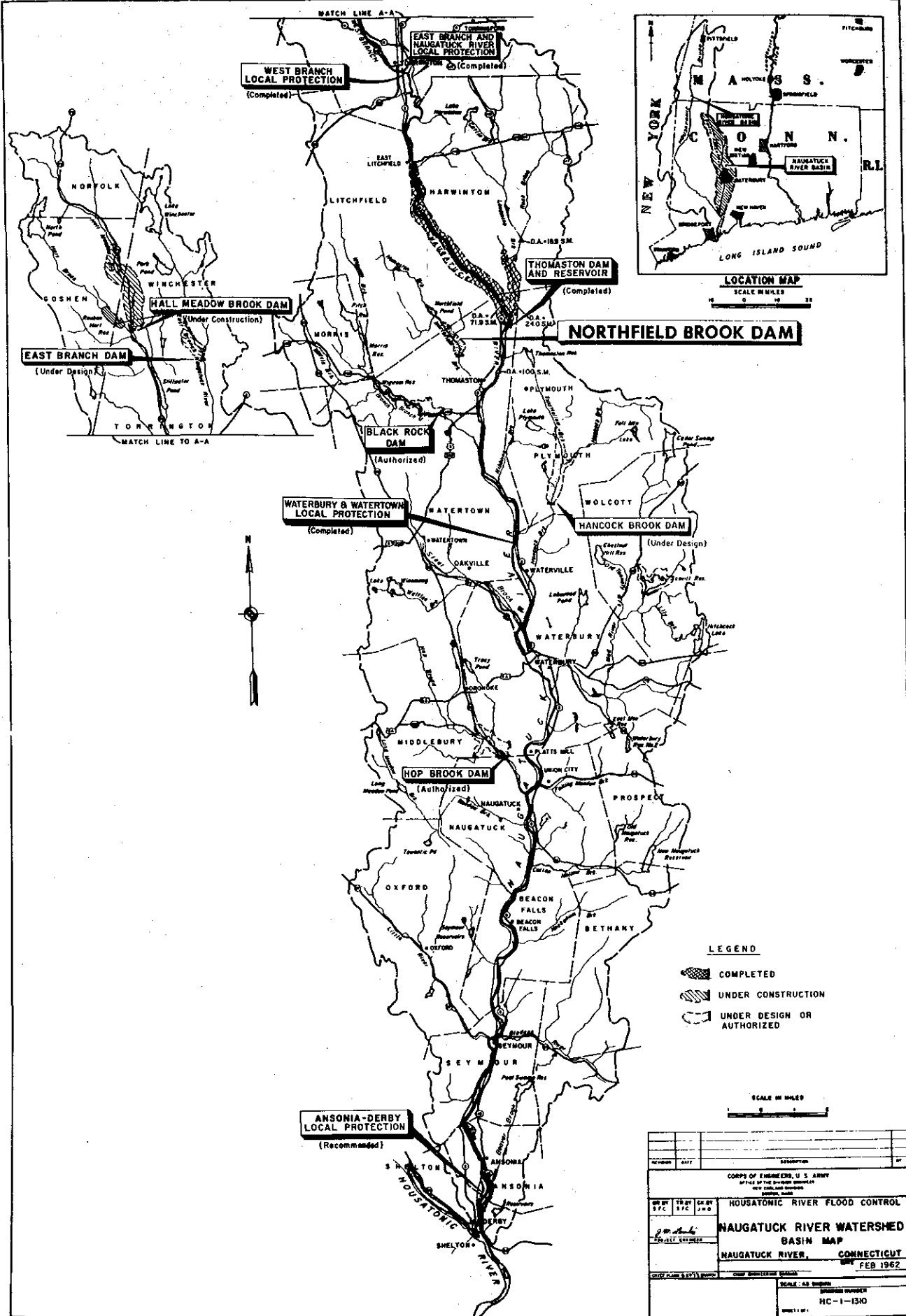
DETAILED COST ESTIMATES
(June 1961 Price Level)

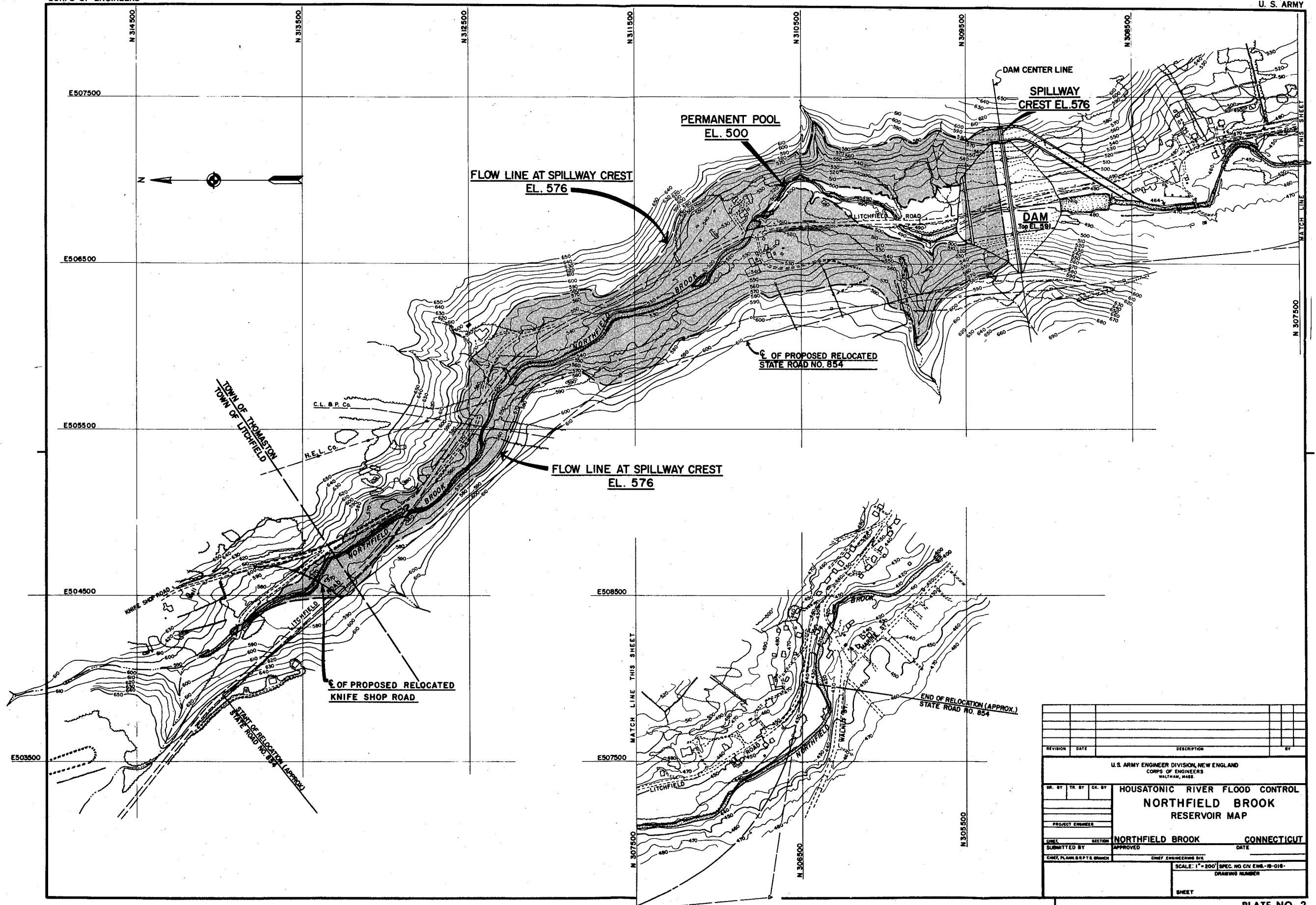
ENR Construction-Cost Index June 1962 = 871.60 (1913 = 100)

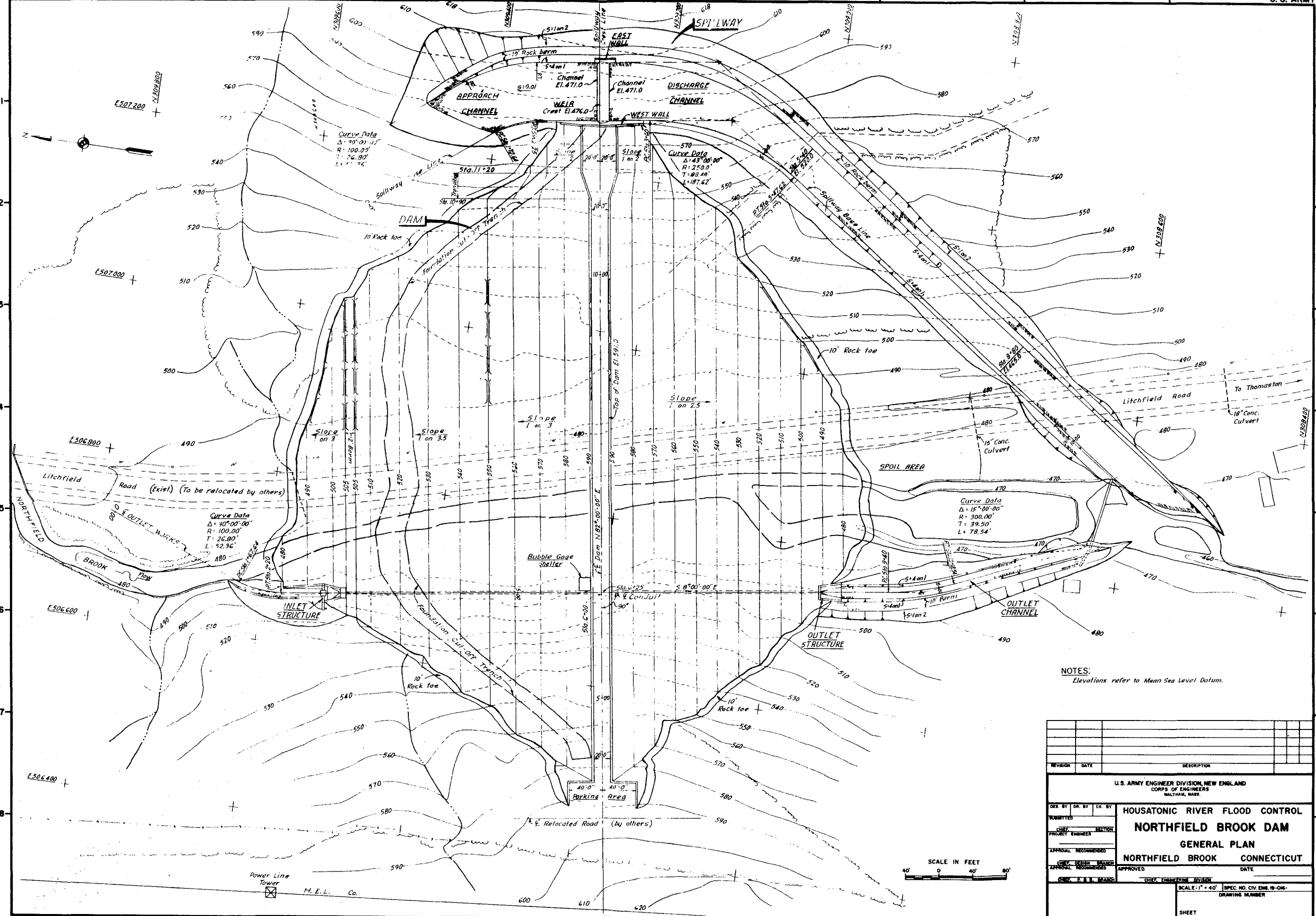
<u>Item</u>	<u>Unit</u>	<u>Quantity</u>	<u>Unit Price</u>	<u>Amount</u>
1. <u>CONSTRUCTION</u>				
A. <u>Northfield Brook Dam</u> <u>& Appurtenant Structures</u> (Embankment-Spillway Outlet Works)				
Preparation of Site	Job	1	L.S.	\$ 20,000
Control & Diversion of Stream	Job	1	L.S.	10,000
Unclassified Excavation - General	C.Y.	70,000	0.60	42,000
Unclassified Excavation - Borrow	C.Y.	630,000	0.70	441,000
Rock Excavation - General	C.Y.	47,000	2.75	129,250
Rock Excavation - Outlet Works	C.Y.	6,500	5.00	32,500
Safety Mesh	S.Y.	6,000	2.00	12,000
Machine Cleaned Bedrock Surface	S.Y.	30,000	0.75	22,500
Hand Cleaned Bedrock Surface	S.Y.	20,000	1.50	30,000
Compacted Earth Fill	C.Y.	465,000	0.20	93,000
Compacted Pervious Fill	C.Y.	35,000	1.30	45,500
Compacted Backfill	C.Y.	500	5.00	2,500

<u>Item</u>	<u>Unit</u>	<u>Quantity</u>	<u>Unit Price</u>	<u>Amount</u>
1. <u>CONSTRUCTION</u>				
A. <u>Northfield Brook Dam</u> <u>& Appurtenant Structures</u> <u>(Cont'd)</u>				
Gravel Drainage Fill	C.Y.	16,000	1.50	24,000
Gravel Bedding	C.Y.	26,000	1.30	33,800
Road Gravel	C.Y.	400	2.00	800
Rock Fill	C.Y.	20,000	0.50	10,000
Rock Slope Protection	C.Y.	34,000	1.00	34,000
Foundation Drilling & Grouting	Job	1	L.S.	30,000
Anchor Bars	Ea.	40	40.00	1,600
Concrete-Inlet Structure and Outlet Structure	C.Y.	500	50.00	25,000
Concrete-Conduit Saddle and Portal	C.Y.	640	30.00	19,200
Concrete-Spillway Wall Lining, Retaining Wall and Weir	C.Y.	620	35.00	21,700
Cement	Bbl.	3,100	6.00	18,600
36" Precast R.C. Pipe	L.F.	544	80.00	43,520
Steel Reinforcement	Lb.	20,000	0.15	3,000
Sluice Gate - 2' x 3'	Job	1	L.S.	4,000
Sluice Gate - 3' x 3'	Job	1	L.S.	6,000
Structural Steel - Trash Rack	Job	1	L.S.	2,000
Chain Link Fence	L.F.	2,000	3.00	6,000

<u>Item</u>	<u>Unit</u>	<u>Quantity</u>	<u>Unit Price</u>	<u>Amount</u>
1. <u>CONSTRUCTION</u>				
A. <u>Northfield Brook Dam & Appurtenant Structures (Cont'd)</u>				
Log Boom	Job	1	L.S.	4,000
Staff Gages	Job	1	L.S.	1,000
Bit. Concrete Pavement	Job	1	L.S.	2,000
Bubble Gage Shelter	Job	1	L.S.	<u>6,000</u>
Sub-Total				1,176,470
Contingencies				<u>123,530</u>
TOTAL - NORTHFIELD BROOK DAM & APPURTENANT STRUCTURES				\$1,300,000
B. <u>Reservoir</u>				4,000
C. <u>Recreation Facilities</u>				<u>50,000</u>
TOTAL CONSTRUCTION COSTS				\$1,354,000
2. <u>RELOCATIONS</u>				
A. <u>Roads</u>				635,000
B. <u>Utilities</u>				<u>92,200</u>
TOTAL RELOCATIONS				\$ 727,200
3. <u>PREAUTHORIZATION STUDIES</u>				10,000
4. <u>SUPERVISION AND ADMINISTRATION</u>				135,800
5. <u>LANDS AND DAMAGES</u>				<u>223,000</u>
Sub-Total				\$2,450,000
6. <u>ENGINEERING AND DESIGN</u>				<u>230,000</u>
TOTAL FEDERAL COST				\$2,680,000







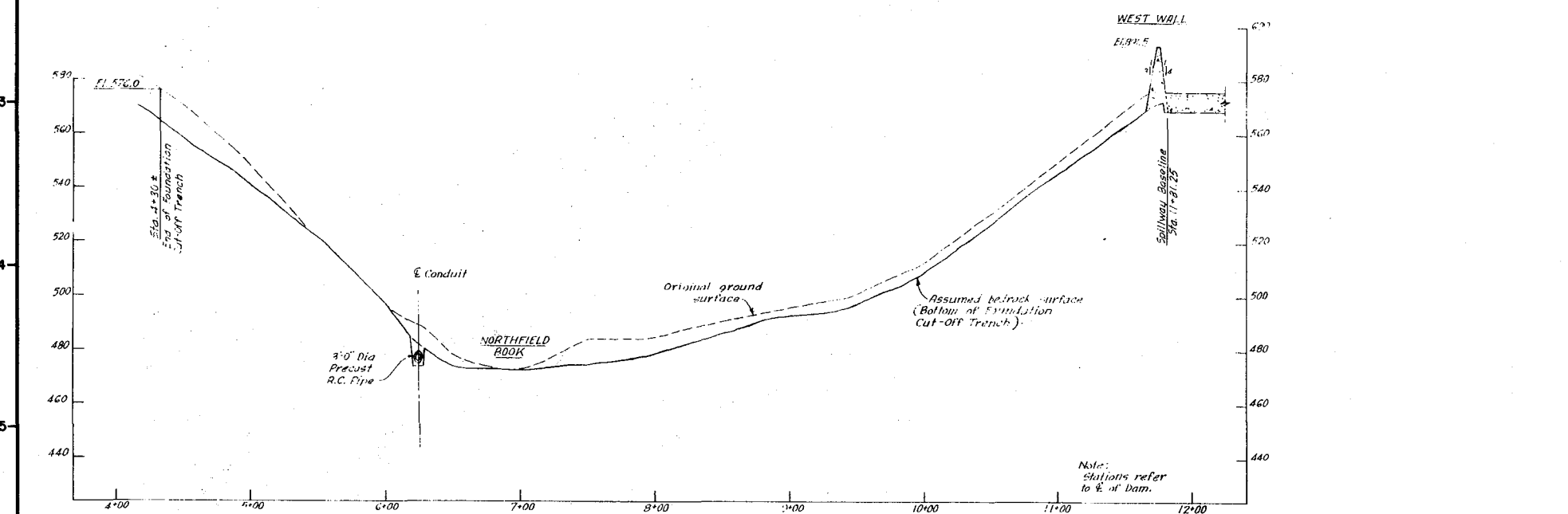
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Elevations refer to Mean Sea Level Datum.

REVISION		DATE	DESCRIPTION
U.S. ARMY ENGINEER DIVISION, NEW ENGLAND CORPS OF ENGINEERS WALTON, MASS.			
DES. BY		DR. BY	CR. BY
SUBMITTED			
PROJECT ENGINEER			
APPROVAL		RECOMMENDED	
APPROVED		DATE	
SHEET			

HOUSATONIC RIVER FLOOD CONTROL
NORTHFIELD BROOK DAM
GENERAL PLAN
NORTHFIELD BROOK CONNECTICUT

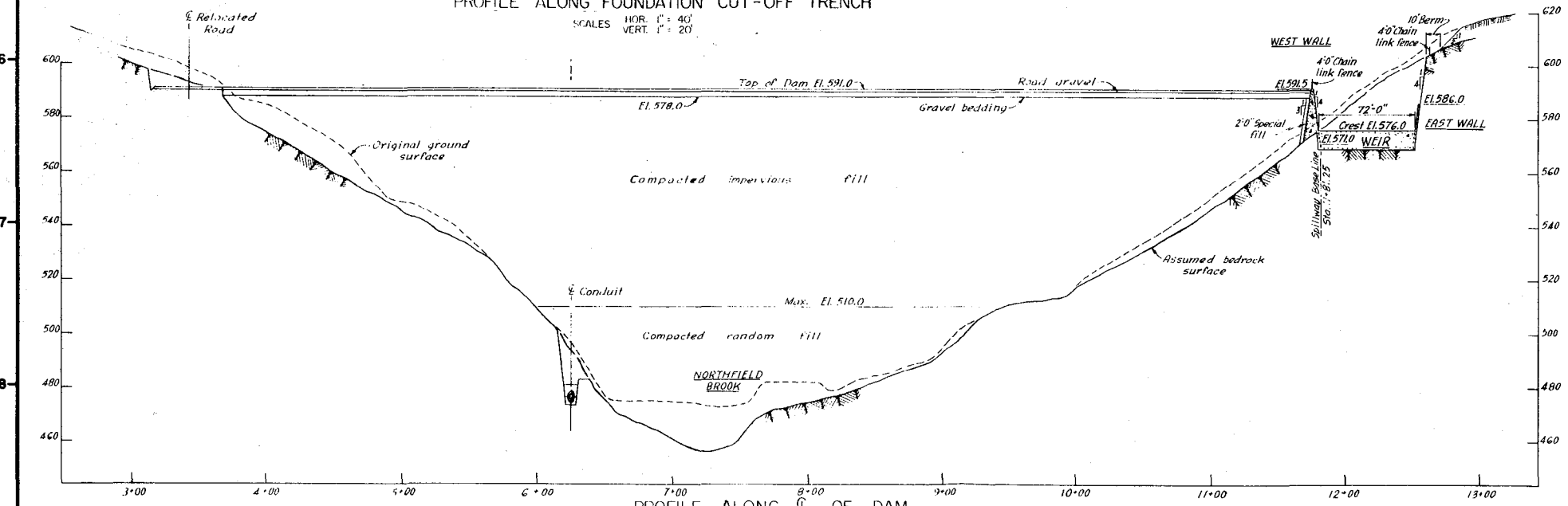
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SPEC. NO. CIV. ENG. 19-016
DRAWING NUMBER

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PROFILE ALONG FOUNDATION CUT-OFF TRENCH

SCALES: HOR. 1" = 40'
VERT. 1" = 20'



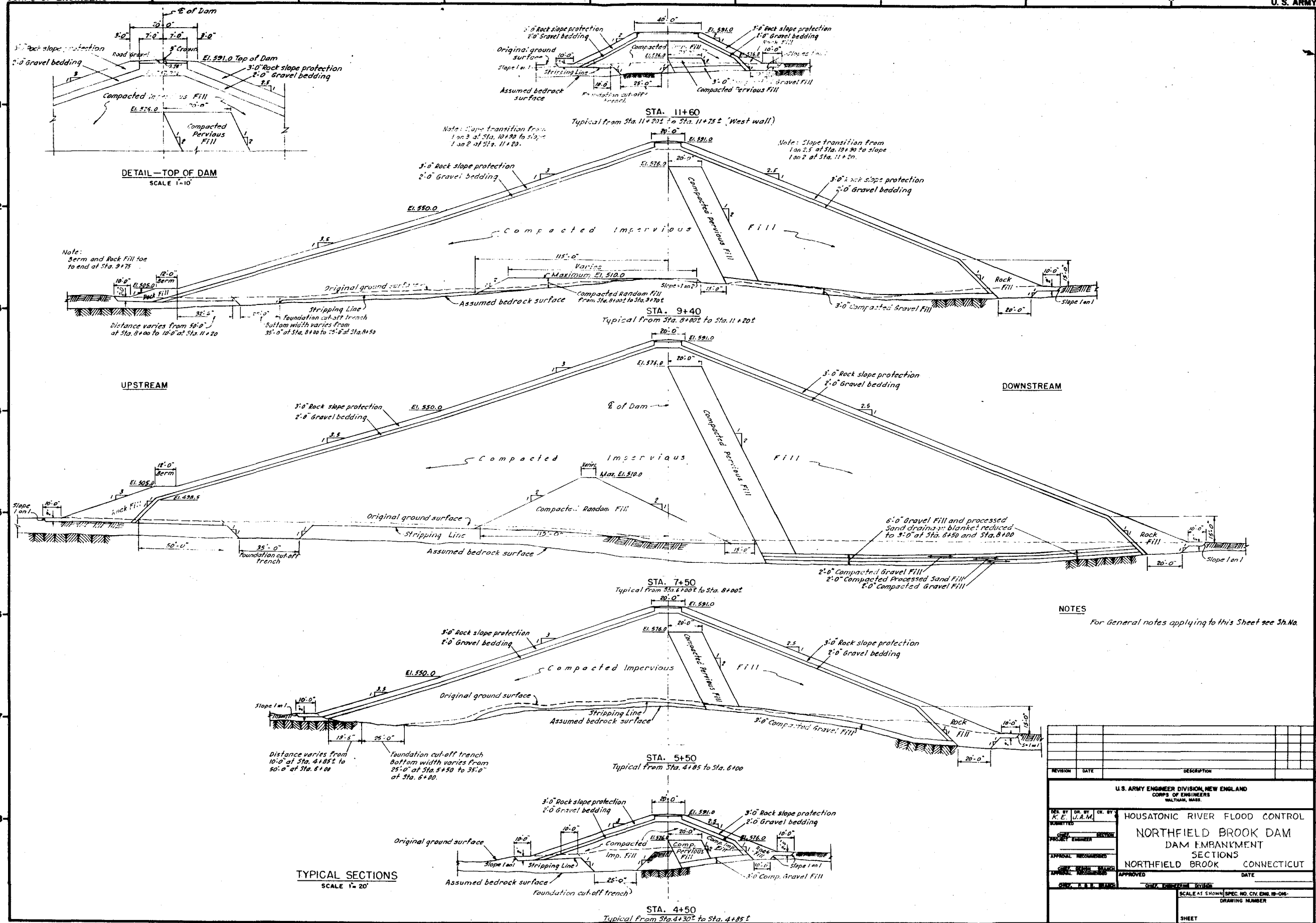
PROFILE ALONG C. OF DAM

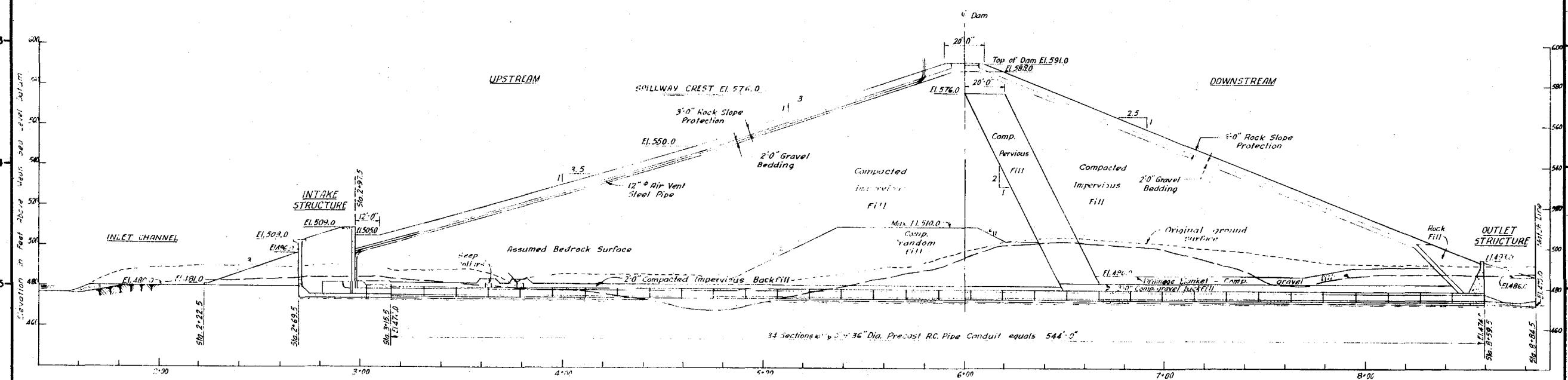
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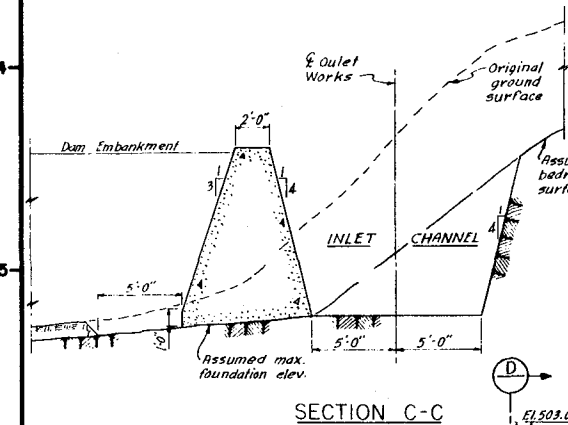
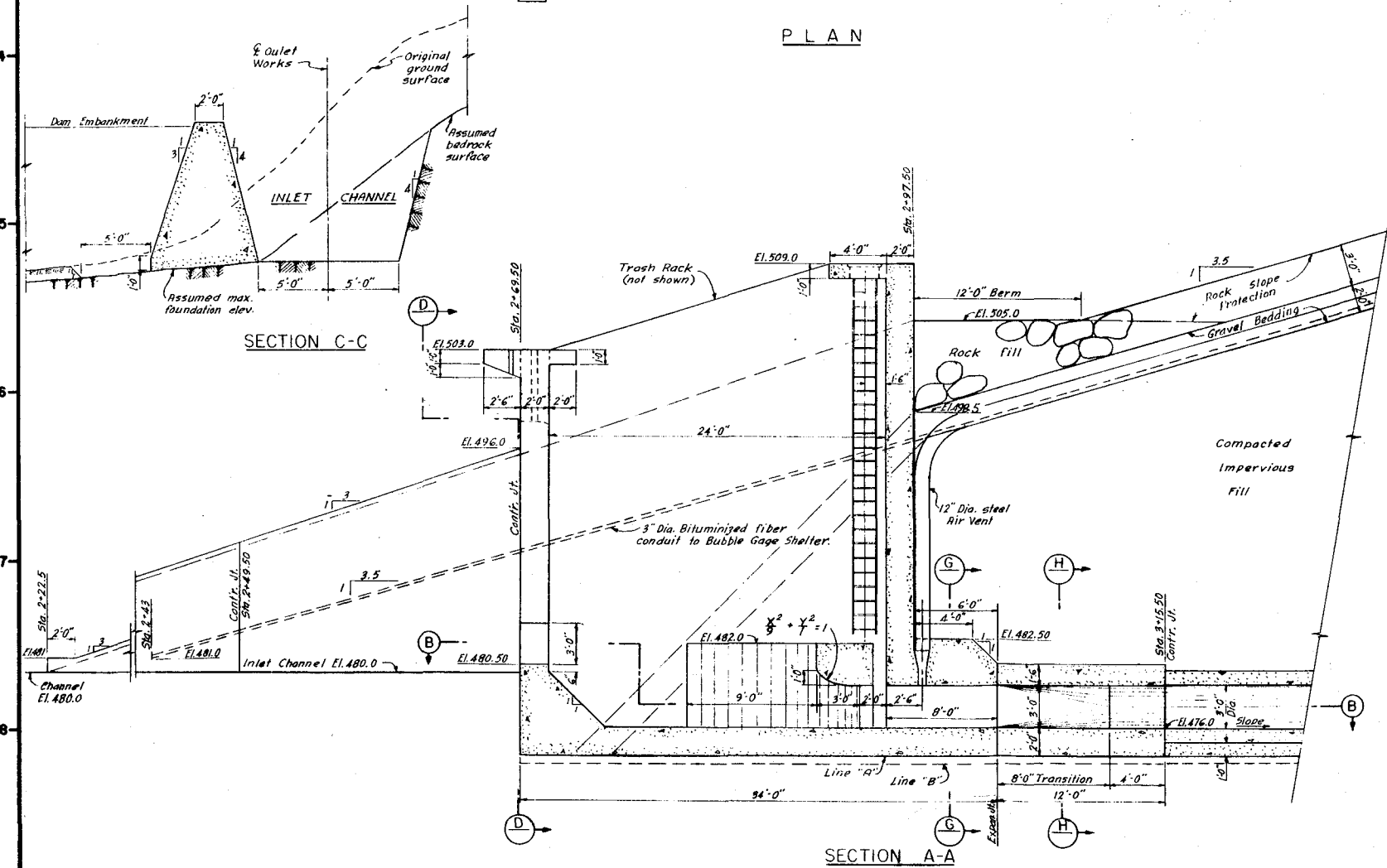
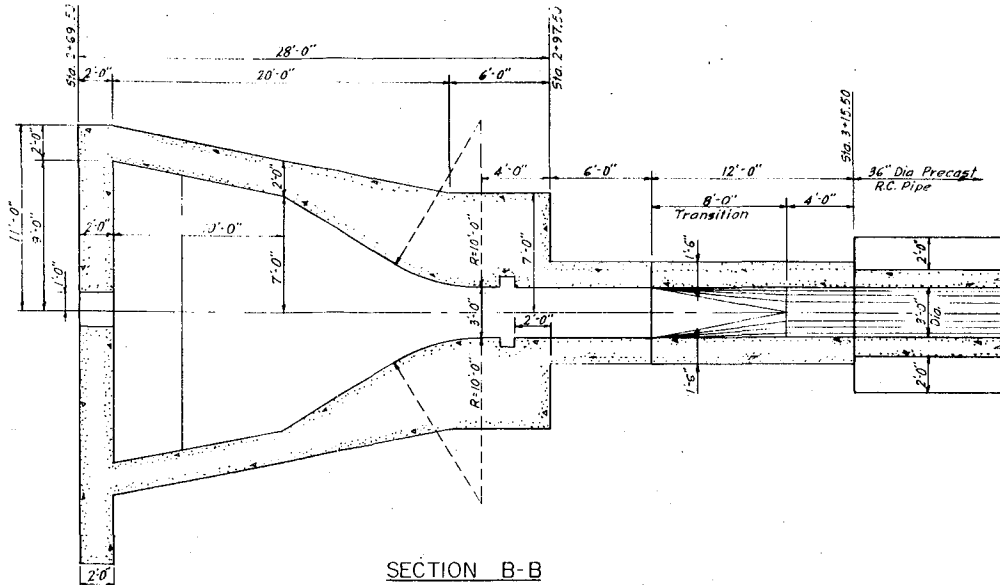
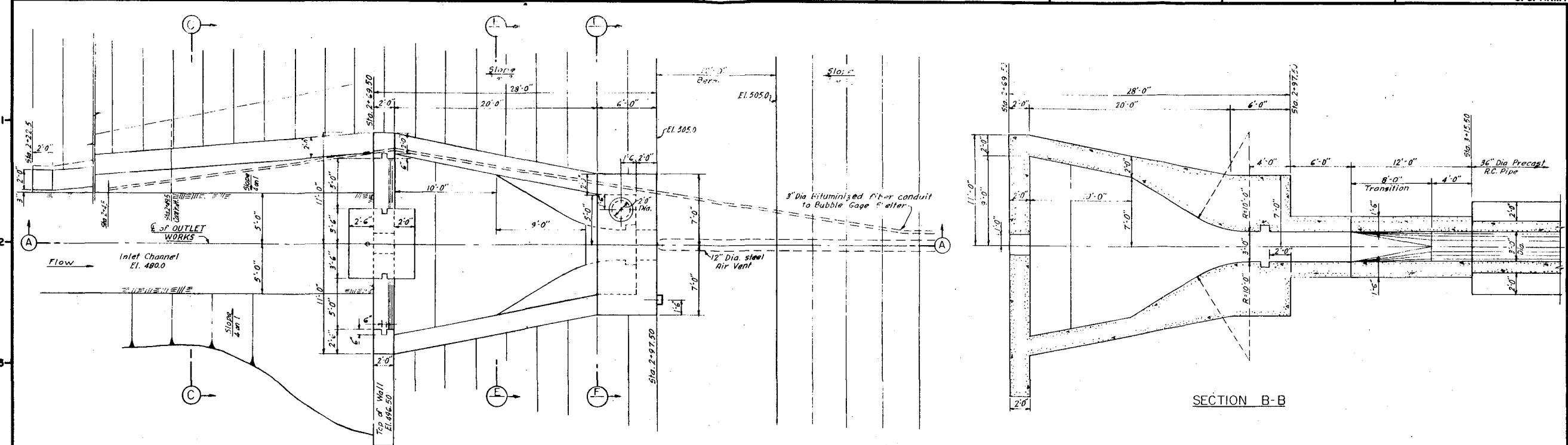
NOTES:
Elevations refer to Mean Sea Level Datum.

REVISION	DATE	DESCRIPTION

U.S. ARMY ENGINEER DIVISION, NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS.	
DES. BY SUBMITTED	DR. BY DATE
PROJECT: HOUSATONIC RIVER FLOOD CONTROL	
DRAWING: NORTHFIELD BROOK DAM EMBANKMENT PROFILES	
LOCATION: NORTHFIELD BROOK, CONNECTICUT	
APPROVAL: APPROVED	DATE: DATE
SHEET: SCALE: SPEC. NO. CIV. ENG. 19-015 DRAWING NUMBER	





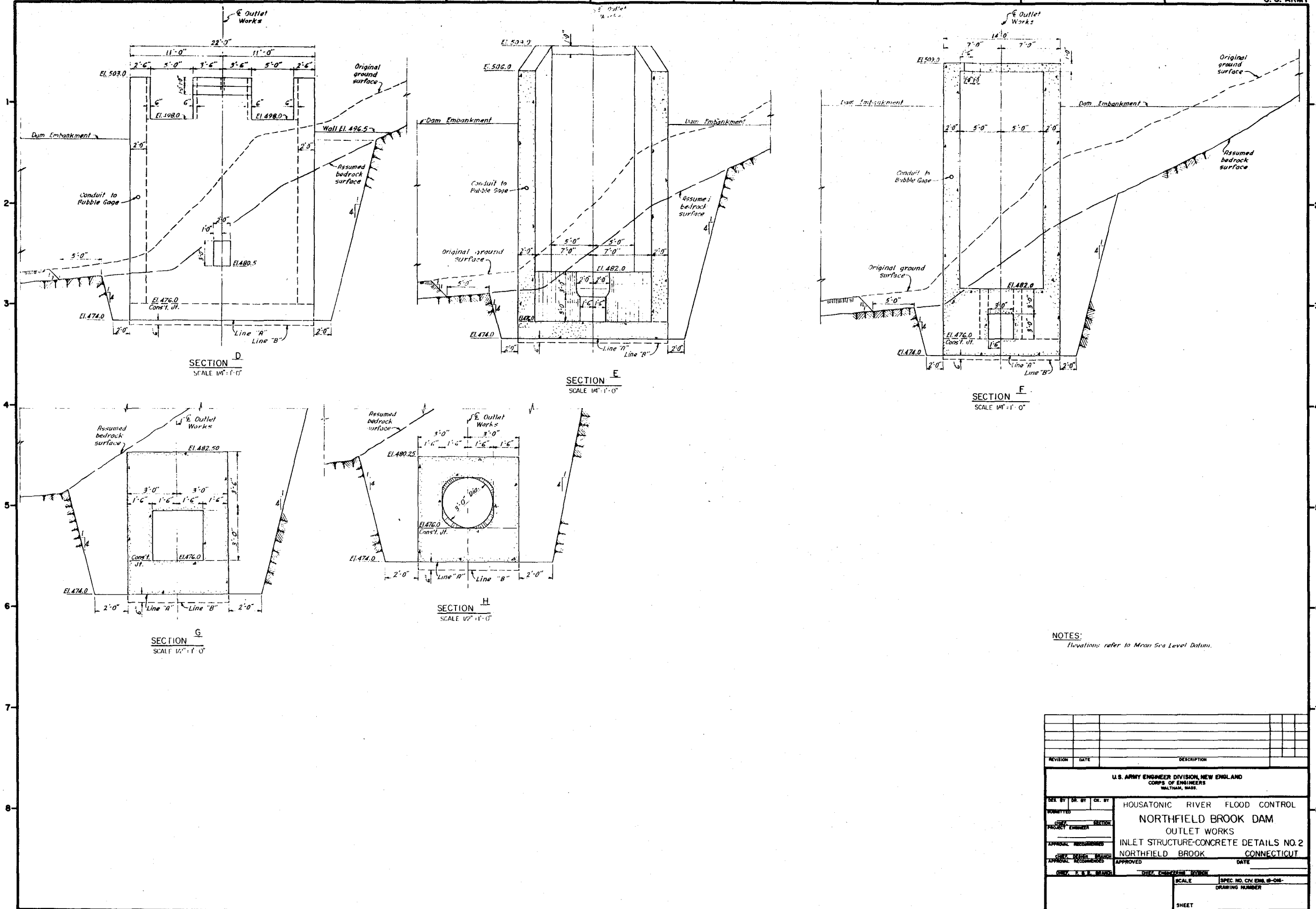


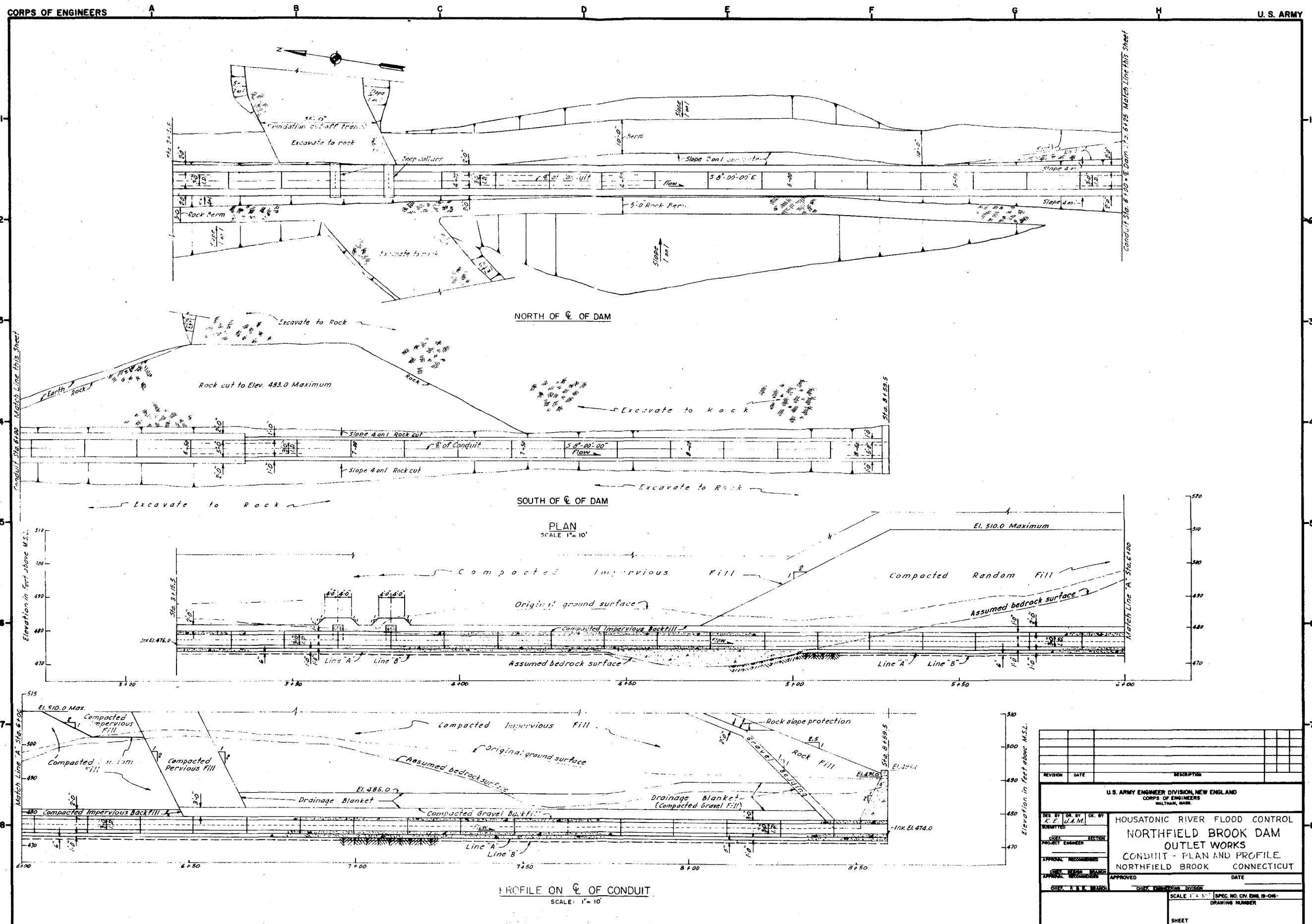
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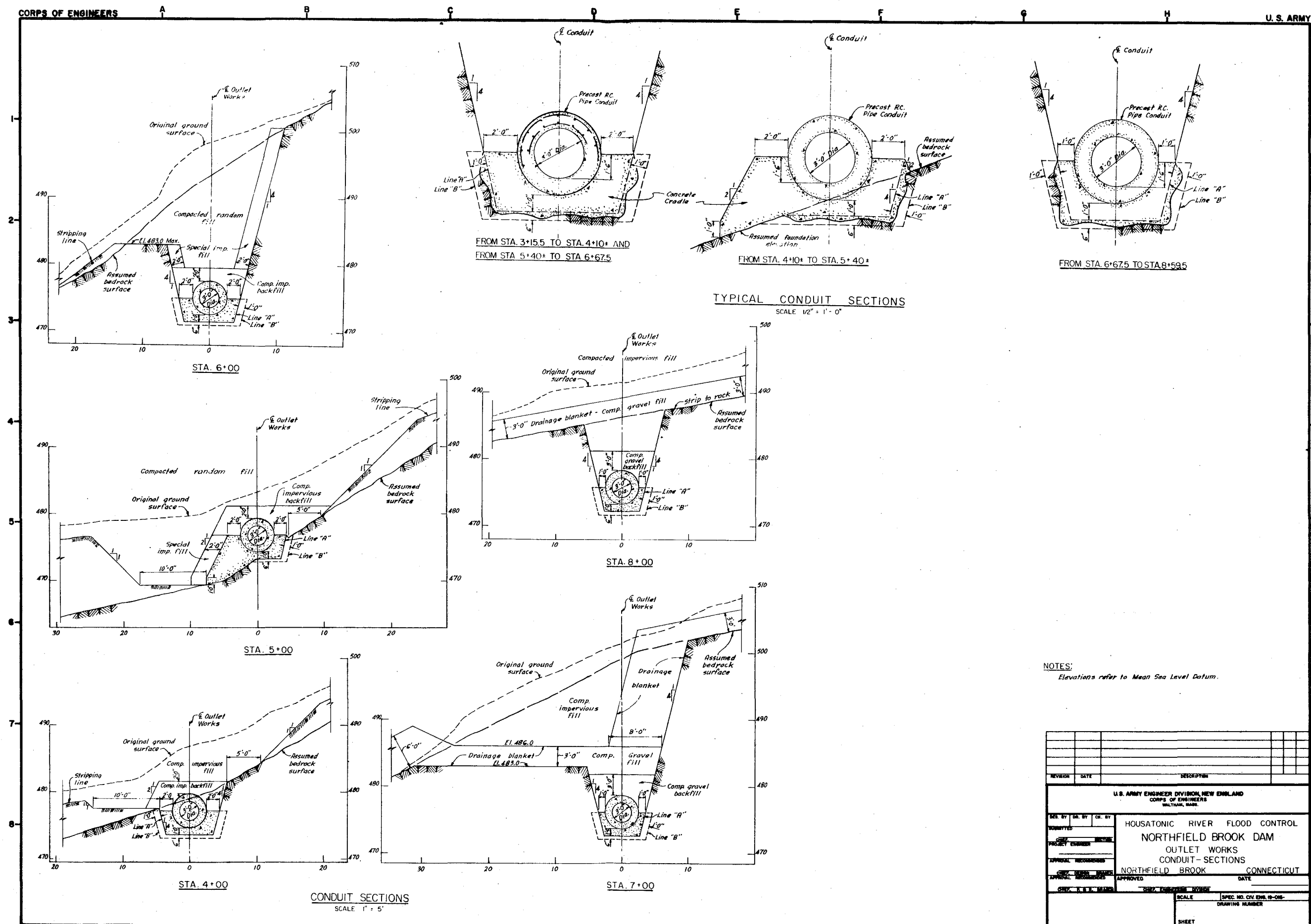


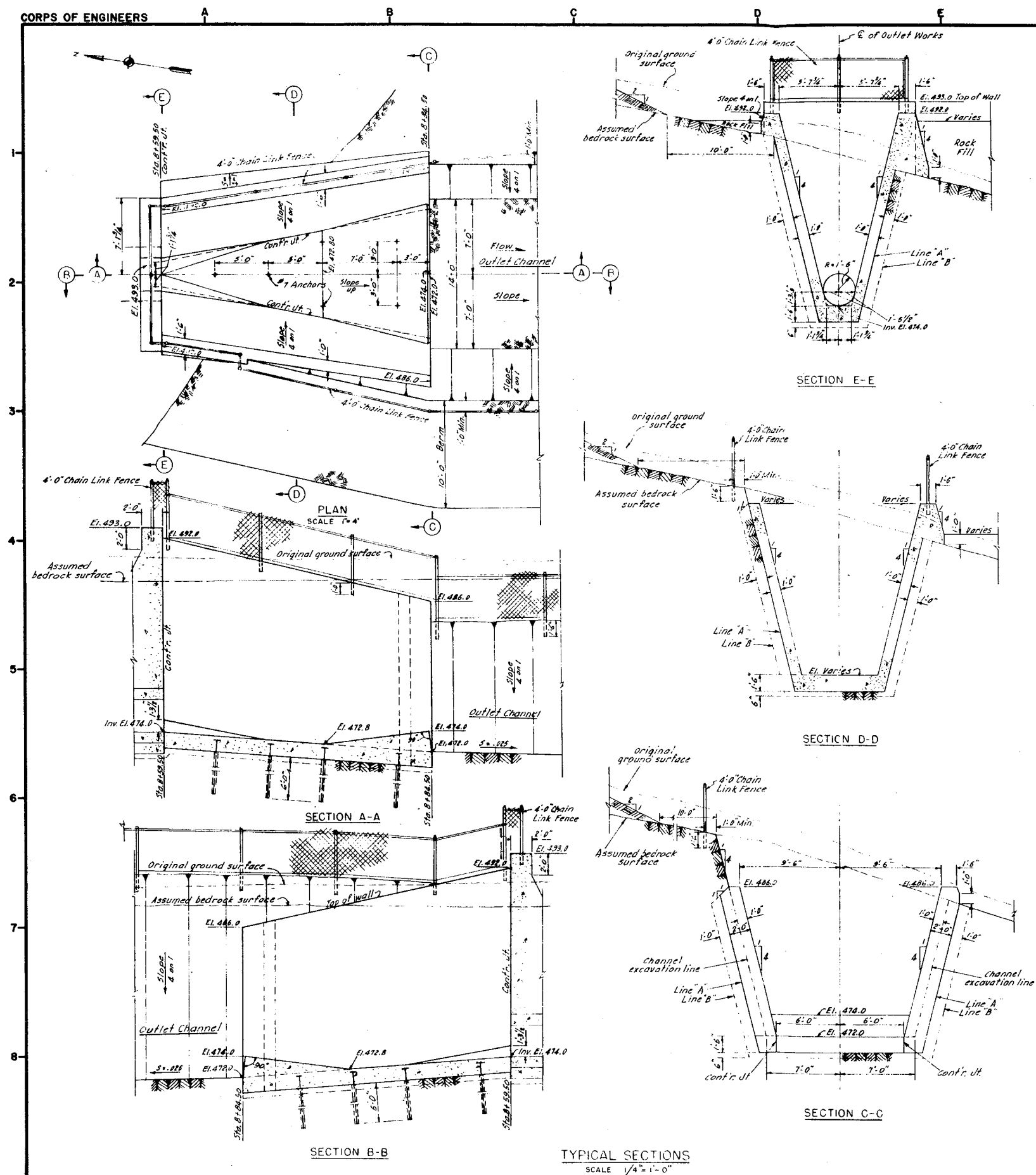
REVISION	DATE	DESCRIPTION

U.S. ARMY ENGINEER DIVISION, NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS.				
DES. BY	DR. BY	CK. BY	HOUSATONIC RIVER FLOOD CONTROL NORTHFIELD BROOK DAM OUTLET WORKS INLET STRUCTURE-CONCRETE DETAILS NO. 1 NORTHFIELD BROOK CONNECTICUT DATE	
SUBMITTED				
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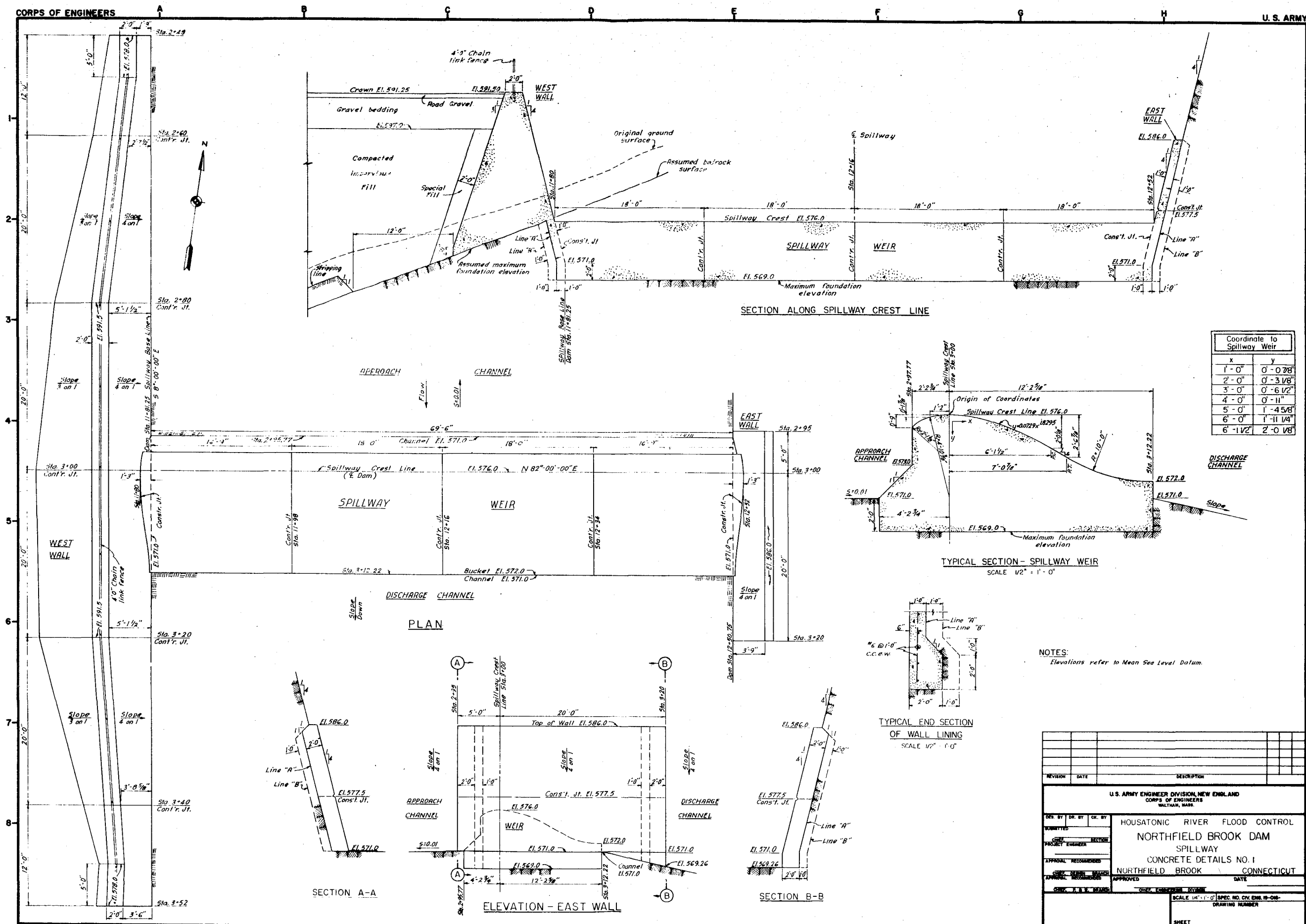
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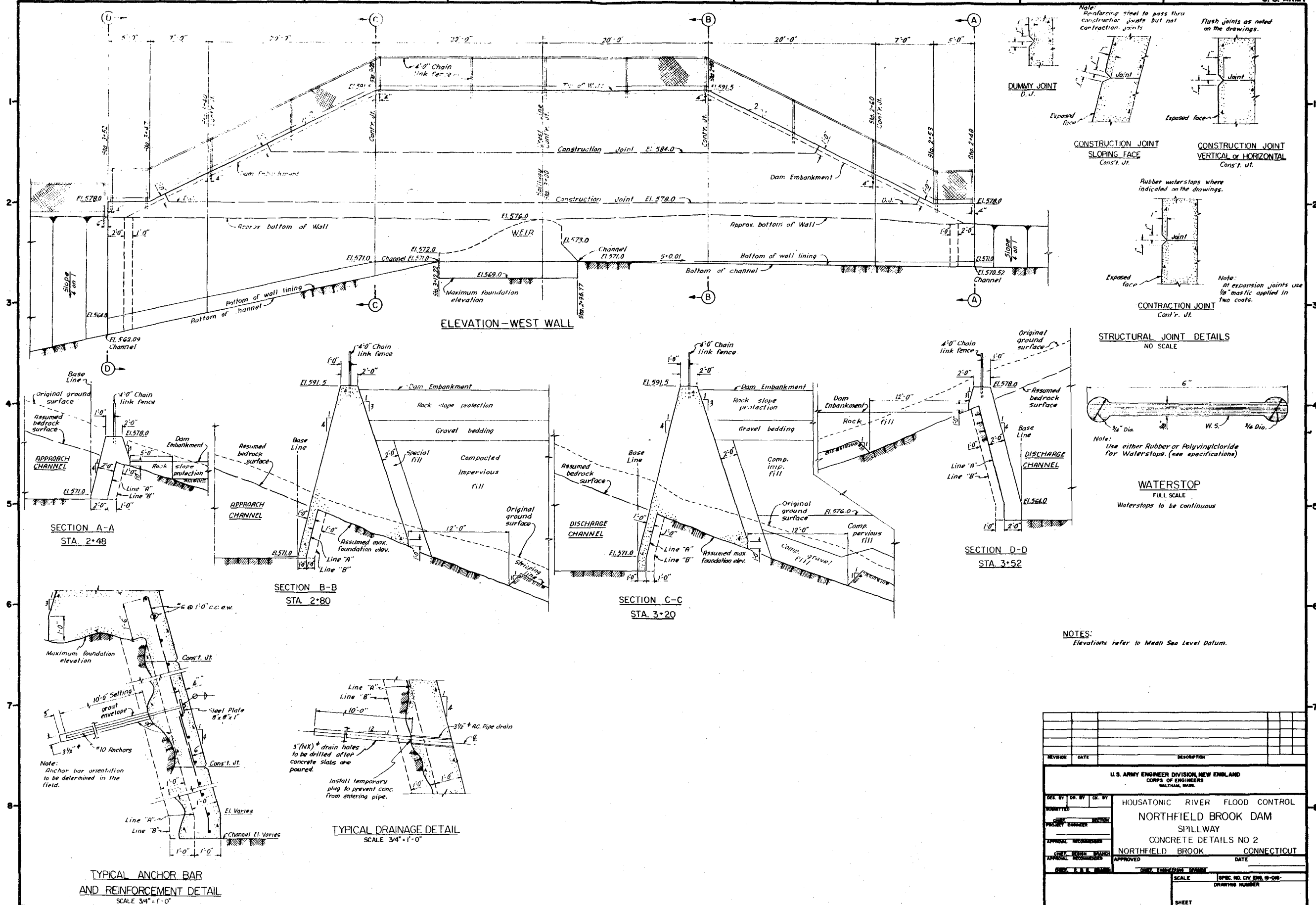
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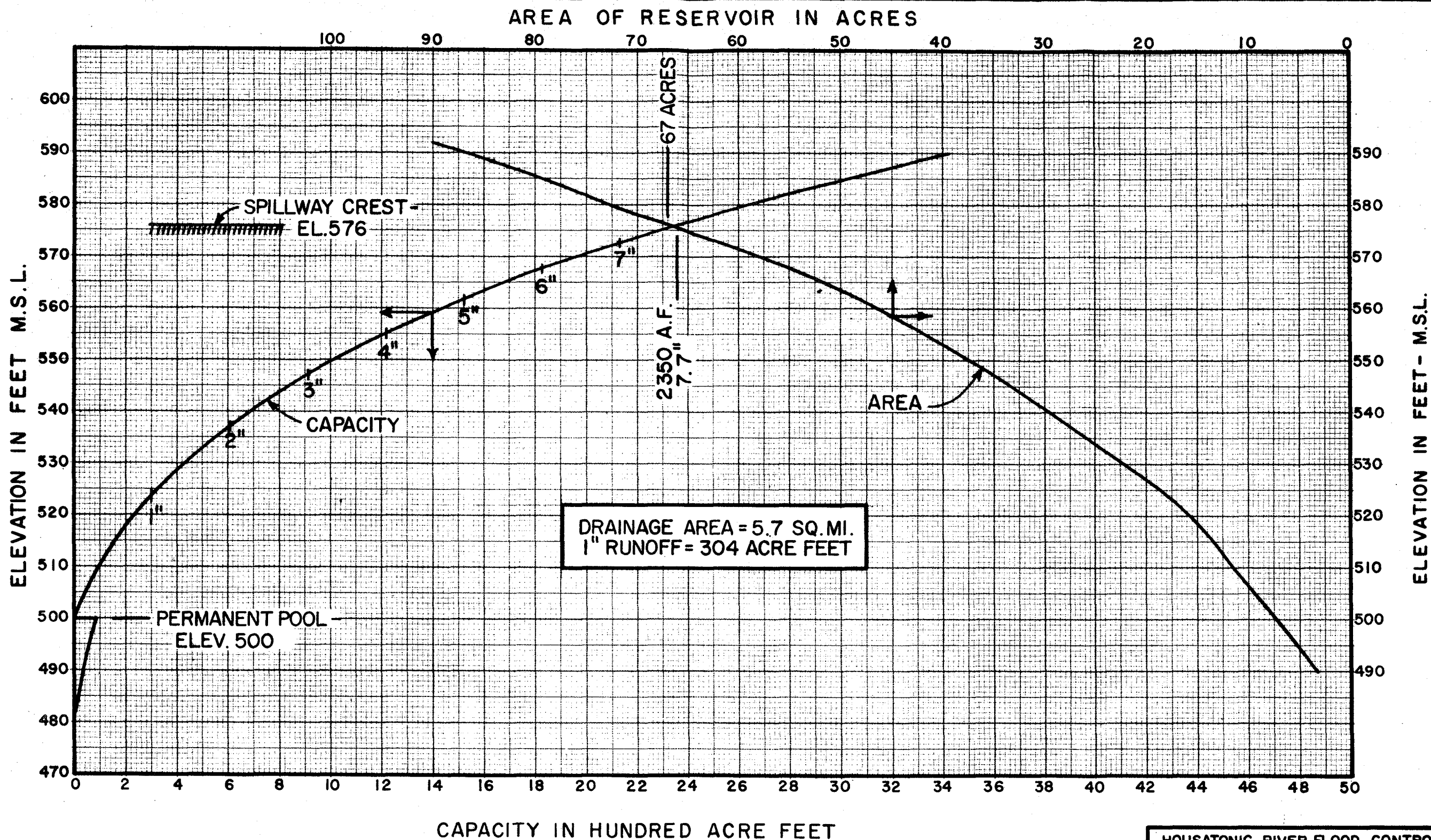
REVISION	DATE	DESCRIPTION

U.S. ARMY ENGINEER DIVISION, NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS.		
DES. BY K. F. J.A.M.	DR. BY 	CH. BY
SUBMITTED		
CHIEF PROJECT ENGINEER	SECTION	
APPROVAL RECOMMENDED		
CHIEF ENGINEER	BRANCH	
APPROVAL RECOMMENDED		
CHIEF J. B. B. BRANCH	APPROVED	
DATE		
SCALE AS SHOWN SPEC. NO. CIV. ENG. 19-016		
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SHEET		









HOUSATONIC RIVER FLOOD CONTROL
NORTHFIELD BROOK RESERVOIR
NORTHFIELD BROOK CONNECTICUT
AREA-CAPACITY CURVES
U. S. ARMY ENGINEER DIVISION
NEW ENGLAND
WALTHAM, MASS. APRIL 1962

U. S. DEPARTMENT OF COMMERCE
BUREAU OF PUBLIC ROADS

248 Farmington Avenue
Hartford 5, Connecticut

June 27, 1961

John Wm. Leslie, Chief, Engineering Division
Corps of Engineers
424 Trapelo Road
Waltham 54, Massachusetts

Dear Sir:

Reference is made to your letter dated June 7, 1961,
requesting our advice as to whether you may expect certification of
the desirability and need for a bridge over Northfield Brook Flood
Control Dam and Reservoir on Northfield Brook in Thomaston, Connecticut.

The State Highway Department and Bureau of Public Roads
are in agreement that there is no need for such a bridge.

Very truly yours,



LEO GROSSMAN
Division Engineer

FEDERAL POWER COMMISSION

REGIONAL OFFICE

139 CENTRE STREET, NEW YORK 13, N. Y.

June 23, 1961

Division Engineer
U. S. Army Engineer Division, New England
Corps of Engineers
424 Trapelo Road
Waltham 54, Massachusetts

Subject: Northfield Brook Flood Control Dam and
Reservoir, Northfield Brook, Thomaston,
Connecticut

Dear Sir:

Reference is made to your letter dated June 7, 1961, requesting our comments with respect to provisions for possible future power or regulation storage at the proposed Northfield Brook Flood Control project in Thomaston, Connecticut.

Based on our review of data furnished with your letter and previous Commission recommendations we concur with your opinion that the Northfield project be constructed without provision for future power development.

Sincerely yours,


D. J. Wait
Regional Engineer

EXHIBIT NO.



DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE

PUBLIC HEALTH SERVICE

Communicable Disease Center
Atlanta 22, Georgia

Refer to:
File No. NEDGW

June 14, 1961

Division Engineer
U. S. Army Engineer Division, New England
Corps of Engineers
424 Trapelo Road
Waltham 54, Mass.

Dear Sir:

Reference is made to your letter of June 7, 1961, concerning the proposed Northfield Brook Flood Control Dam and Reservoir on Northfield Brook in Thomaston, Connecticut.

Our comments and recommendations included in Exhibit 2 of your "Interim Report on Review of Survey, Housatonic River Basin, Naugatuck River, Connecticut" (dated June 30, 1958) still pertain.

It is noted that present plans provide for a permanent impoundment with an area of 7.5 acres at elevation 500.0 feet, m.s.l.

It is also noted that it is planned to clear the reservoir to elevation 500.0 feet. Such clearing should be adequate from the standpoint of mosquito control.

We appreciate the opportunity to review the project plans.

Sincerely yours,

Leslie D. Beadle
Chief Biologist
Water Resources Activities



ADDRESS ONLY THE
REGIONAL DIRECTOR

UNITED STATES
DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
BUREAU OF SPORT FISHERIES AND WILDLIFE
59 TEMPLE PLACE
BOSTON, MASSACHUSETTS

NORTHEAST REGION
(REGION 5)
MAINE
NEW HAMPSHIRE
NEW YORK
VERMONT
PENNSYLVANIA
MASSACHUSETTS
NEW JERSEY
RHODE ISLAND
DELAWARE
CONNECTICUT
WEST VIRGINIA

July 27, 1961

Division Engineer
New England Division
U. S. Army Corps of Engineers
424 Trapelo Road
Waltham 54, Massachusetts

Dear Sir:

Reference is made to your letter of June 27, 1961 which transmitted to our office new area-capacity curves for the authorized Northfield Brook Flood Control Dam and Reservoir on Northfield Brook in Thomaston, Connecticut.

This information has been reviewed with representatives of the Connecticut State Board of Fisheries and Game. They concur in the determination that the expected change in the project as indicated by the newly computed area-capacity curves will not significantly alter the views expressed in our report of April 25, 1960 on the effect of this project on the fish and wildlife resources. No further report or revisions in our original report are considered necessary.

The opportunity to comment on the relationship of your new data to the fish and wildlife interests is appreciated.

Sincerely yours,


John S. Gottschalk
Regional Director



ADDRESS ONLY THE
REGIONAL DIRECTOR

UNITED STATES
DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
BUREAU OF SPORT FISHERIES AND WILDLIFE
59 TEMPLE PLACE
BOSTON, MASSACHUSETTS

NORTHEAST REGION
(REGION 5)
MAINE
NEW HAMPSHIRE
NEW YORK
VERMONT
PENNSYLVANIA
MASSACHUSETTS
NEW JERSEY
RHODE ISLAND
DELAWARE
CONNECTICUT
WEST VIRGINIA

April 25, 1960

Division Engineer
New England Division
U. S. Army Corps of Engineers
424 Trapelo Road
Waltham, Massachusetts

Dear Sir:

This letter constitutes our report on the fish and wildlife aspects of 4 proposed flood control reservoirs on the Naugatuck River in Litchfield and New Haven Counties, Connecticut. These sites include Black Rock, Hancock Brook, Hop Brook and Northfield Brook, none of which have been authorized. This report has been reviewed by the Connecticut State Board of Fisheries and Game. The report, and specifically the recommendations which follow, have been endorsed by the Connecticut State Board of Fisheries and Game as indicated in the letter to me dated March 17, 1960, from Director Lyle M. Thorpe of that Board, a copy of which is appended.

Comments were previously submitted concerning these and other sites in our letters of December 14, 1956, and May 22, 1958.

The 4 projects under consideration are located on tributaries to the Naugatuck River, in the Housatonic River Basin. The tributaries enter the Naugatuck downstream from the Thomaston Dam and Reservoir currently under construction. None of the proposed sites are farther than 9 miles from the city of Waterbury, the largest population center in this highly industrialized and urbanized basin.

DESCRIPTION OF FISH AND WILDLIFE RESOURCES
IN RELATION TO PROJECT PLAN

Hancock Brook Dam and Reservoir

Project Plan

The Hancock Brook Dam site is located in the town of Plymouth 3.4 miles upstream from the confluence of Hancock Brook and the

Naugatuck River. At the spillway crest elevation of 484 feet,^{1/} the flood pool will have a surface area of about 265 acres. The dam will be 50 feet high, 615 feet long and will store 3,820 acre-feet of water. The 5-year flood pool at elevation 475 feet will have a surface area of approximately 200 acres. The dam will be provided with a 48-inch ungated conduit. The surcharge elevation will be 10 feet above the spillway.

Fish and Wildlife Resources (Without the Project)

Hancock Brook is an important local trout stream. The State Board of Fisheries and Game stocks this stream annually with large numbers of trout. In 1959 a total of 1,450 yearling, and 25 2-year-old brook trout, 500 2-year-old brown trout, and 75 2-year-old rainbow trout were stocked. This fishery resource provides about 3,000 angler-days of recreation every year.

The reservoir area differs from the other 3 projects in that it encompasses a large area of brushy swampland. Almost the entire area offers good to excellent habitat for cottontail rabbit and pheasant. Lesser amounts of habitat are available for waterfowl, grouse, woodcock, squirrel, mink and muskrat. The State regularly stocks pheasant in the site and in 1959, 125 adult birds were released. About 2,000 hunter days are expended in harvesting the stocked pheasants and the other resident and migratory game species.

Fish and Wildlife Resources (With the Project)

Periodic flooding within the reservoir area will inundate long reaches of streams within the site due to the low gradient of the basin. Over 2.8 miles of Hancock and Todd Hollow Brooks will be inundated whenever the reservoir reaches the spillway crest elevation. Every year a total of about 2 miles of streams will be inundated and 2.4 miles will be inundated every 5 years. It is expected that the trout habitat within the stream mileage annually inundated will be depreciated considerably in value. Streams encompassed in flood storage pools to be held at less frequent intervals will suffer less damaging effects. Trout habitat below the dam site will suffer some temporary damages from siltation during project construction.

The anticipated annual flood pool will inundate about 130 acres of good small game habitat. Every 5 years, about 200 acres will be inundated and at the spillway crest elevation, about 265 acres will be inundated. Some changes in the vegetative composition

^{1/} All elevations in this report are in feet and refer to mean sea level datum.

resulting from inundation can be expected, but this change will probably be minimal within the 1-year level since existing vegetation is adapted to a certain amount of flooding. Indiscriminate borrow operations would cause more serious losses to the wildlife resource at Hancock Brook than at any of the other reservoir sites.

Northfield Brook Dam and Reservoir

Project Plan

The Northfield Brook Dam site is located 1 mile upstream from the confluence of Northfield Brook and the Naugatuck River in Thomaston. The 118-foot high dam will be approximately 800 feet long and is designed to store 2,430 acre-feet of water. A pool held at spillway crest elevation of 573 feet will have a surface area of about 60 acres. The spillway is designed for a 10-foot surcharge. The 5-year flood pool will have a surface area of about 35 acres at elevation 540. Control of the reservoir will be accomplished by means of a 36-inch ungated conduit.

Fish and Wildlife Resources (Without the Project)

Northfield Brook is a locally important trout stream and receives moderate angling pressure. The stream is stocked annually by the State. In 1959, 150 yearling brook trout were stocked and these were supplemented by some natural reproduction in the stream.

The 60-acre reservoir area provides very limited habitat for small game species, due to present land uses and the proximity to the highway. Hunting pressure on the area is negligible.

Fish and Wildlife Resources (With the Project)

At the spillway crest elevation the reservoir pool will inundate 1.2 miles of Northfield Brook. Every year approximately a $\frac{1}{2}$ mile of stream will be inundated and about 0.6 mile will be inundated every 5 years. Periodic flooding will result in direct losses to the production and utilization of the fishery resource.

Potential wildlife production and utilization with the reservoir area will be detrimentally effected. Changes in vegetative composition can be expected, more notably in the lower most frequently flooded portions of the reservoir, which will influence utilization by wildlife species.

Hop Brook Dam and Reservoir

Project Plan

The Hop Brook dam site is located on Hop Brook in the town of Middlebury about 1.2 miles upstream from the confluence of Hop Brook and the Naugatuck River. A small portion of the reservoir area at the dam site lies within Whittemore Glen State Park.

The proposed dam will be approximately 470 feet long, 82 feet high and will store 6,840 acre-feet of water. The surcharge elevation will be 10 feet above the spillway crest. At spillway crest elevation of 362 feet, the surface area of the flood pool will be about 280 acres. Flows through the 48-inch conduit will be controlled by means of 2-3 X 3 foot hydraulically operated gates. The 5-year flood pool at elevation 342 feet would inundate about 150 acres.

Fish and Wildlife Resources (Without the Project)

Hop Brook is considered a locally important trout stream and is stocked annually. In 1959, the State released 1,400 yearling brook trout, 25 2-year-old brook trout and 150 2-year-old brown trout. It is estimated that the stream provides 2,250 angler-days of recreation annually.

The partly wooded reservoir area provides high quality small game habitat and involves lands where the State Board of Fisheries and Game has hunting agreements with landowners. These occur at the upper part of the reservoir site and form part of the Naugatuck Regulated Shooting Area. Despite some posting against access, the project area provides a total of about 1,220 hunter-days recreational annually, about three quarters of this hunting effort being expended in harvesting rabbit, woodcock, grouse, and squirrel. The remainder is accounted for by hunters seeking pheasant which are stocked by the State.

Fish and Wildlife Resources (With the Project)

The reservoir pool at spillway crest elevation would inundate about 1.6 miles of Hop Brook, 0.8 mile of Wooster Brook and 0.3 mile of Welton Brook. Every year, the flood pool is expected to reach an elevation which will inundate 1.2 miles of Hop Brook and 0.5 mile of Welton and Wooster Brooks. Construction activities, annual flooding, and the permanent pool will eventually cause the loss of some, if not all, of the trout angling opportunities now existing.

Flooding to the spillway crest is expected only infrequently; therefore upper elevation areas, including that part of the Naugatuck Regulated Shooting Area within the site, will be subject to minor effects. Frequent flooding to lower elevations will result in more apparent changes in vegetative cover and use by wildlife. Production of wildlife species will be adversely affected, utilization of habitat will be restricted and hunter utilization of this resource will be limited because of flooding at various seasons of the year. Annually, about 90 acres will be flooded and approximately 150 acres will be inundated every 5 years. State Park lands, where hunting is prohibited, accounts for about 14 acres at the annual flood pool area and 20 acres at the 5-year level.

Black Rock Dam and Reservoir

Project Plan

The dam site for the Black Rock project is located on Branch Brook, 1.8 miles upstream from its confluence with the Naugatuck River in Thomaston. Over 70 percent of the reservoir area will lie within the boundaries of Black Rock State Park. A dam 153 feet high and approximately 1,100 feet long will store 8,860 acre-feet of water. At the spillway crest elevation of 513 feet, the reservoir will have a surface area of 180 acres. The 5-year flood pool will have a surface area of 115 acres at elevation 477. Operation of the dam will be accomplished by means of a 54-inch conduit with 2-3 foot by 4 foot hydraulically operated gates. The spillway is designed for a 15-foot surcharge.

Fish and Wildlife Resources (Without the Project)

Branch Brook is considered an excellent trout stream. The Fish Division, of the Connecticut State Board of Fisheries and Game, is using sections of this stream as a study area. In 1959 the stream was stocked with 575 yearling brook trout and 200 2-year-old brown trout. Natural brown trout reproduction provides additional fish for the angler. The fishery resource provides approximately 1,500 angler-days of recreation annually.

Hunting is prohibited in Black Rock State Park, and since the major portion of the reservoir area is State Park land the very small acreage open to hunting receives light pressure. The greater part of the reservoir area is forested and provides good habitat for grouse, squirrels and rabbit.

Fish and Wildlife Resources (With the Project)

At the spillway crest elevation the reservoir will inundate 1.3 miles of Branch Brook. Slightly over a mile of stream will be inundated by the annual flood pool which will be 74 feet deep at the dam. Periodic inundation will result in losses to the stream fishery through siltation, and prevention of angling for short periods of time during and after the flooding period.

DISCUSSION

The Naugatuck River Basin has a population greater than 215,200, of which 90 percent live in urbanized areas of the 5 cities and 28 towns. As an indication of the demands placed on the fish and wildlife resources of the project area, the number of licensed sportsmen within a 10-mile radius of each site averages about 15,000, expending about 77,000 man-days afield annually. Under existing conditions, the project areas meet about 3 percent of this demand, with

the Hop Brook and Hancock Brook areas bearing the greater share of use. If recommendations contained in this report are followed, it is expected that the reservoir areas will be able to meet the maximum possible share of the local demand.

It is understood that the planning agency is recommending the inclusion of permanent pools at each site. At Hancock Brook, a permanent pool at elevation 460 would provide a surface area of 54 acres 6 feet deep at the dam. A large portion of this pool would be less than 3 feet deep. A permanent pool at Northfield Brook would be held at elevation 497 and have a surface area of 7.5 acres 25 feet deep at the dam. At Hop Brook, a permanent pool at elevation 310 would have a surface area of 25 acres and be 14 feet deep at the dam. At elevation 420, a permanent pool at Black Rock would be 36 feet deep at the dam and have a surface area of 15 acres. Reservoir clearing operations will be conducted within the maximum permanent pool level at the 4 sites.

Provision for control of water levels and for drawdown at each permanent pool are important to the management of the fish and wildlife resources. Stop-log type structures appear to be most desirable, and should control the entire elevation of the permanent pools at Hancock Brook and Hop Brook. Control of the upper 10-15 feet of the Black Rock pool, and provision for drawdown of the Black Rock and Northfield Brook permanent pools will be satisfactory. The permanent pools will be managed in a manner not inconsistent with authorized project purposes and the possibility exists that the pools may be drawn down at times for indefinite periods.

Provisions for the inclusion of permanent pools at each of these 4 reservoir sites with water control structures will adequately mitigate fish and wildlife losses resulting from project construction. In addition, it is felt that the measures discussed in the following paragraphs will create further fish and wildlife benefits at no more than incidental cost to the project.

The Hancock Brook site appears to have high potential value as a fish and wildlife management area. The State Board of Fisheries and Game desires that a General Plan for the conservation and development of fish and wildlife resources be executed for this reservoir area. They feel that the best present use of the Hancock Brook reservoir will be to develop it as a small game public hunting area under an intensive management plan. This plan will be geared primarily to developing the most effective pheasant management program, although benefits will accrue to other game species as well. Pheasant stocking, as a management feature, will be employed in a manner best suited to habitat conditions and hunter pressure. Modification of habitat, including that which provides wildlife food as well as cover, will be undertaken in order to adapt the area to best fit into this intensive type management plan. Under a wildlife

management plan, it is anticipated that the permanent pool will be held only periodically for management purposes such as control of vegetation, and so long as the downstream area of Hancock Brook maintains its value for trout.

Those portions of existing roads within the project sites and the railroad bed at the Hancock Brook site, will be valuable for future public access to the reservoir areas and permanent pools. While it is realized that some deterioration of these roads is inevitable during project construction, this deterioration should be minimized as much as possible.

A public access to the pool at the Hop Brook site appears feasible where Route 63 will enter the upper end of the pool. The point where Litchfield Street will enter the upper end of the permanent pool at the Northfield Brook site appears to be the most feasible location for a public access and boat launching point. It is understood that the Corps of Engineers will provide public access, including boat launching and vehicle parking facilities, at these 4 reservoir areas. Therefore, specific provisions for public access have not been made the subject of a recommendation.

Since all of the reservoir sites are small, construction activities and borrow operations will be more or less concentrated. Destruction of the existing vegetation along extensive portions of stream banks will increase damages to existing fisheries. Discharges of large quantities of mud and silt into the streams during construction will damage downstream fisheries values. It is realized that it is impossible to prevent silting of streams during construction operations, without involving additional costs. However, in order to minimize damages to fish and wildlife resources during construction it is recommended that representatives of this office and the State Board of Fisheries and Game be consulted at the time contract specifications are drawn up. It may be possible for fish and wildlife personnel to suggest at this time, means for reducing damages as a procedure in assuring that the reservoir area is left in as good a condition as possible for public use following construction.

The State Board of Fisheries and Game considers the expansion of lands for public hunting and fishing a key endeavor in its overall program. The State Board of Fisheries and Game desires to make an attempt to obtain hunting and fishing rights on lands upon which the construction agency will take flowage easements at the Hop Brook, Northfield Brook and Hancock Brook sites. The best means of accomplishing this appears to be through close coordination with the construction agency when that agency takes the flowage easements. This would mean that a State representative would negotiate for hunting and fishing rights at the same time as a representative of the construction agency is taking flowage easements.

Continuance of the existing commercial sand and gravel operations within the Hancock Brook reservoir site would be detrimental to fish and wildlife management of the reservoir area. Elimination of stream silting from this operation would improve the fishery potential of the stream, and the permanent pool.

RECOMMENDATIONS

We recommend:

1. That provisions be made for permanent pools at each site with approximately the following depths at the dam: Hancock Brook Dam, 6 feet; Northfield Brook Dam, 25 feet; Hop Brook Dam, 14 feet; and Black Rock Dam, 36 feet.

2. That permanent pool water control structures provide for the following: control of the entire pool elevation at Hancock Brook Dam and Hop Brook Dam; drawdown of the pool at the Northfield Brook Dam; and control of the upper 10-15 feet and drawdown at the Black Rock Dam.

3. That Federal lands and included water areas within the Hancock Brook project area, be made available to the Connecticut State Board of Fisheries and Game in accordance with a General Plan for wildlife management as provided in Sections 3 and 4 of the Fish and Wildlife Coordination Act, except for such portions as may be reserved by the construction agency for reasons of safety, efficient operation or protection of public property.

4. That insofar as possible the following roads and railroad bed within reservoir boundaries be preserved for public access purposes: Hancock Brook Dam, Todd Hollow Road, Waterbury Road and the bed of the New York-New Haven Railroad; Northfield Brook Dam, Litchfield Street; Hop Brook Dam, Routes 63, 188, and Bristol Street; and Black Rock Dam, Route 109 and Northfield Street.

5. That, insofar as possible, deposition of sediment in streams be minimized and existing streamside vegetation be maintained within 50 feet of stream banks at all sites except within permanent pool areas.

6. That representatives of the Connecticut State Board of Fisheries and Game and this office be consulted at the time contract specifications are drawn up to consider the most feasible means of minimizing damages to fish and wildlife habitat as a result of construction operations.

7. That the taking of flowage easements by the construction agency be coordinated with the anticipated taking of public fishing and hunting easements by the State at the Hop Brook, Northfield

Brook, and Hancock Brook Reservoir sites.

8. That no commercial sand and gravel operations be permitted within lands acquired by the Federal Government at Hancock Brook Reservoir.

9. That additional detailed studies of fish and wildlife resources affected by the project be conducted as necessary during further planning and construction phases of the project to form the basis for such reasonable modifications for the conservation and development of fish and wildlife resources as may be desirable to obtain maximum overall project benefits.

10. That additional modifications to achieve maximum project benefits to be made in project facilities or operations, subsequent to completion of construction, as may be desirable to obtain maximum overall project benefits, on the basis of follow-up studies by this Bureau to improve or supplement measures taken for the conservation and development of fish and wildlife resources, notwithstanding Paragraph (g) Section 2 of the Fish and Wildlife Coordination Act.

Sincerely yours,



John S. Gottschalk
Regional Director

Attachment

STATE OF CONNECTICUT
BOARD OF FISHERIES AND GAME
2 Wethersfield Avenue
Hartford, Connecticut

C
O
P
Y

March 17, 1960

Mr. John S. Gottschalk
Regional Director
Fish and Wildlife Service
59 Temple Place
Boston, Mass.

Dear Mr. Gottschalk:

This Department has completed its review of the draft copies of the fish and wildlife reports pertaining to the Upper Naugatuck River Basin projects and the Hall Meadow Brook Reservoir project.

These reports, including their conclusion and recommendations, have my complete endorsement and we are willing to accept the responsibilities inherent in the execution of a General Plan.

Sincerely yours,

/s/ Lyle M. Thorpe
Director

AL/B